State of Iowa

1968

Laws
Rules and Regulations

Governing The Handling, Storage And Transportation Of Flammable Liquids

HAROLD E. HUGHES,
Governor

Published By
THE STATE OF IOWA
Des Moines

HAROLD E. HUGHES
GOVERNOR

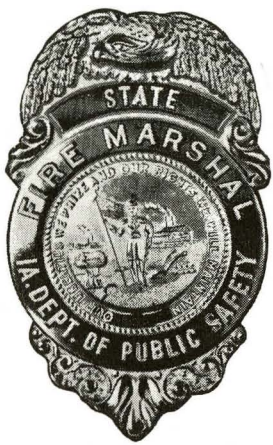
JACK M. FULTON
COMMISSIONER

STATE OF IOWA

1968 LAWS

Rules and Regulations

GOVERNING THE HANDLING, STORAGE AND TRANSPORTATION OF FLAMMABLE LIQUIDS



WILBUR R. JOHNSON

STATE FIRE MARSHAL

DEPARTMENT OF PUBLIC SAFETY

Lucas State Office Building — Des Moines, Iowa

PB15362

TABLE OF CONTENTS

FLAMMABLE LIQUID CODE

DIVISION I

DIVISION II

DIVISION III

FOREWORD

The material contained in the Laws, Rules and Regulations Governing the Handling, Storage and Transportation of Flammable Liquids is intended to provide a reasonable degree of fire safety to life and property, avoiding provisions which might result in inconvenience and expense not essential to this objective. The recommendations are phrased in terms of performance or objectives. Recognition is given that, due to the possibility of human or mechanical failure, complete reliance for fire safety should not rest exclusively on any single safeguard.

WILBUR R. JOHNSON

STATE FIRE MARSHAL

CODE OF IOWA

1966

CHAPTER 101

FLAMMABLE LIQUIDS AND LIQUEFIED PETROLEUM GASES

101.1 Rules and regulations by fire marshal. The state fire marshal is hereby empowered and directed to formulate and adopt and from time to time amend or revise and to promulgate, in conformity with and subject to the conditions set forth in this chapter, reasonable regulations for the safe transportation, storage, handling and use of flammable liquids and liquefied petroleum gases. For purpose of this chapter: "Flammable liquid" means a liquid having a flash point below two hundred degrees fahrenheit and a Reid vapor pressure not exceeding forty psi absolute. "Liquefied petroleum gas" means material composed predominantly of any of the following hydrocarbons, or mixtures of the same: Propane, propylene, butanes (normal butane or isobutane) and butylenes.

101.2 Scope of rules. The regulations shall be in keeping with the latest generally recognized safety criteria for the materials covered of which the applicable criteria recommended and published from time to time by the National Fire Protection Association shall be prima facie evidence.

101.3 Advisory committee. The regulations covering flammable liquids and those covering liquefied petroleum gas shall be separately formulated and separately promulgated. To assist in the formulation of these regulations the state fire marshal shall appoint and confer respectively with an advisory committee on flammable liquids and an advisory committee on liquefied petroleum gas. Each advisory committee shall consist of persons designated by the state fire marshal and who are representative of interests in this state and are experienced in matters of fire prevention and safety with respect to the materials to be covered.

101.4 Nonconforming use. The regulations shall make reasonable provision under which facilities in service prior to the effective date of the regulations and not in strict conformity therewith may be continued in service unless the nonconformity is such as to constitute a distinct hazard to life or adjoining property; and for guidance in enforcement may delineate these types of nonconformity that should be considered distinctly hazardous, those that should not be considered distinctly hazardous and those the need for elimination of which should be evaluated in the light of local factors. As to any regulation the need for compliance with which is conditioned on local factors, the regulations shall provide, as a condition precedent to evaluation or issuance of a compliance order, for reasonable notice to the proprietor of the facility affected of intention to evaluate the need and of the time and place at which he may appear and offer evidence thereon.

101.05 Publication of rules. The regulations shall be promulgated pursuant to chapter 17A, only after a public hearing at least twenty days notice of the time and place of which is given by publication in a newspaper of general circulation throughout the state and by mail to any person who has filed his name and address with the state fire marshal for the purpose of receiving the notice.

101.6 Ordinances by municipalities. Regulations promulgated pursuant to this chapter shall have uniform force and effect throughout the state and no municipality or political subdivision shall enact or enforce any ordinance or regulation inconsistent or not in keeping with the state-wide regulations. Provided that nothing in this chapter shall in any way impair the power of any municipality when authorized by other law to regulate the use of land by comprehensive zoning or to control the construction of buildings and structures under building codes or restricted fire district regulations. Provided, further, that the size, weight and cargo carried by vehicles used in the transportation or delivery of flammable liquids or liquefied petroleum gas shall be governed by the uniform provisions of the motor vehicle and highway traffic laws of this state and local ordinances therein authorized.

101.7 Enforcement. Compliance with the regulations may be enforced by orders of the state fire marshal subject to review, appeal and enforcement as provided in chapter 100 for orders for elimination of fire-hazard conditions, except that the regulations may provide for compliance time, other than as specified in section 100.26 based upon the amount and character of work, availability of suitable equipment or materials and appropriate continued operation of any facility.

101.8 Assistance by local officials. The chief fire prevention officer of every city, town or village having an established fire prevention department, the chief of the fire department of every other city, town or village in which a fire department is established, the mayor of every town or city in which no fire department exists, the township clerk of every township outside the limits of any city, town or village and all other local officials upon whom fire prevention duties are imposed by law shall assist the state fire marshal in the enforcement of the regulations.

FLAMMABLE LIQUIDS CODE

DIVISION I

Provisions of General Application

101 Definitions

101-01 "Approved" is defined as being acceptable to the State Fire Marshal. Any equipment, device or procedure which bears the stamp of approval of or meets applicable standards prescribed by an organization of national reputation such as the Interstate Commerce Commission, Underwriters Laboratories, Inc., Factory Mutual Laboratories, American Society for Testing Materials, National Board of Fire Underwriters, National Fire Protection Association, American Society of Mechanical Engineers, American Petroleum Institute or American Standards Association, which undertakes to test and approve or provide standards for equipment, devices or procedures of the nature prescribed in these regulations shall be deemed acceptable to the State Fire Marshal.

101-02 "Barrel" shall mean a volume of 42 U. S. gallons.

101-03 "Crude Petroleum" shall mean hydrocarbon mixtures that have a flash point below 150°F. and which have not been processed in a refinery.

101-04 "Flammable Liquid" shall mean any liquid having a flash point below 200°F. and having a vapor pressure not exceeding 40 pounds per square inch (absolute) at 100°F.

Flammable liquids shall be divided into three classes as follows:

CLASS I shall include those having flash points at or below 20°F.

Typical examples are: Ether, gasoline, benzol, collodion, acetone, carbon disulphide (disulphide), methyl acetate.

CLASS II shall include those having flash points above 20°F. but at or below 70°F.

Typical examples are: Denatured alcohol, toluol, methyl alcohol.

CLASS III shall include those having flash points above 70°F

Typical examples are: Kerosene, amyl alcohol, turpentine, mineral spirits, stoddard solvent, fuel oil.

The volatility of flammable liquids is increased when artificially heated to temperatures equal to or higher than their flash points. When so heated Class II and III liquids shall be subject to the applicable requirements for Class I or II liquids. High flash point liquids which otherwise would be outside of the scope of these regulations, may be subjected thereto when they are so heated.

101-05 "Flash Point" shall mean the minimum temperature in degrees Fahrenheit at which a flammable liquid will give off flammable vapor as determined by appropriate test procedure and apparatus as specified below.

The flash point of flammable liquids having a flash point below 175°F. (79°C.) shall be determined in accordance with the Standard Method of Test for Flash Point by Means of the Tag Closed Tester (A.S.T.M. D56-52).

The flash point of flammable liquids having a flash point of 175°F. or higher shall be determined in accordance with the Standard Method of Test for Flash Point by Means of the Pensky-Martens Closed Tester (A.S.T.M. D93-52).

101-06 "NFPA" means the National Fire Protection Association.

101-07 "Vapor Pressure" shall mean the pressure, measured in pounds per square inch (absolute) exerted by a volatile liquid as determined by the "Standard Method of Test for Vapor Pressure of Petroleum Products (Reid Method)," (A.S.T.M. D323-55). This method is also the standard for the American Standards Association (A.S.A. Z11.44-1955).

101-08 "Container" shall mean any can, bucket, barrel, drum or portable tank, except stationary tanks, tank vehicles, and tank cars.

101-09 "Important Building" shall mean any structure having a total of at least two hundred (200) square feet of floor area; or any structure, regardless of floor area, which is designed or used for human habitation or occupancy.

102 Modifications

Modifications of the requirements of these regulations may be obtained upon application therefor in writing to the State Fire Marshal in individual cases (a) where specifically provided for in these regulations, (b) where strict compliance is impracticable or would result in hardship to the applicant and the departure sought would not constitute a distinct hazard to life or adjoining property and (c) to the extent necessary to permit replacement of existing facilities that are in unservicable or hazardous condition.

DIVISION II

Storage, Handling and Use

CHAPTER I

General Provisions

101 Application and Scope

101-01 Application: These regulations shall apply to all persons, firms, corporations, copartnerships, governmental agencies except Federal, and voluntary associations storing, handling or using flammable liquids, and to the owner or lessee of any building, premises, or equipment in or on which flammable liquids are stored, handled, or used.

101-02 Scope: The regulations in this Division II shall apply to flammable liquids as hereinbefore defined; except that they shall not apply to the transportation of flammable liquids in bulk nor to transportation when in conformity with Interstate Commerce Commission regulations or regulations lawfully on file with and approved by the Interstate Commerce Commission.

102 Retroactivity

102-01 Insofar as the regulations in this Division II cover operational practice or use of containers, they shall apply and be enforced as to all plants, stations, establishments and facilities, wherein or whereon flammable liquids are stored, handled or used, whether existing and in service as of the effective date of this act or subsequently established or placed in service. Regulations covering physical installations shall apply to all plants, stations, establishments and facilities erected or installed or first devoted to flammable liquid storage, handling, or use on or after the effective date of these regulations and, to the extent specifically provided for or to the extent necessary to eliminate any distinct hazard to life or adjoining property, shall apply to existing establishments and facilities devoted to storage, handling or use of flammable liquid prior to the effective date of these regulations. For purposes of this section, nonconformity with the regulations in this chapter, existing as of the effective date thereof,

(1) With respect to the location or arrangement of buildings, tanks, platforms or docks, or to spacing

or clearances between these installations or between these installations and adjoining property lines, shall not be deemed to be distinctly hazardous and may be allowed to continue;

(2) With respect to vents or pressure relief devices on tanks, control valves on tanks or in piping systems, ventilation or sources of ignition shall be deemed distinctly hazardous and shall be corrected or eliminated;

(3) Otherwise than as covered in (1) or (2) of this subsection -01 and otherwise than with respect to operational practice and container use shall be subject to evaluation as provided in subsection 102-02 before any order for the elimination thereof is issued.

At any plant, station or establishment existing and devoted to flammable liquid use as of the effective date of these regulations, existing nonconformity the continuance of which is allowed under the foregoing provisions shall not prevent the installation of additional or replacement facilities which in and of themselves are in conformity with these regulations.

102-02 Where under the regulations in this Division II the application of a requirement to an establishment or facility is conditioned upon a determination of need or upon a determination of whether the continuance of a nonconformity existing as of the effective date of these regulations will or will not constitute a distinct hazard, then before any determination is made or order issued in the premises, the proprietor of the establishment or facility to be affected shall be given an opportunity to be heard with at least 10 days' written notice of time and place. In the evaluation due consideration shall be given to all existing protection and fire safety devices and the extent to which they eliminate or modify the need or hazard.

102-03 Correction or Elimination of Existing Nonconformity in Physical Installations: Where required correction or elimination of existing nonconformity necessitates the obtaining and installation of additional devices or structural protection or the emptying or temporary non-use of one or more facilities, then a reasonable time, considering the amount of work to be done, the availability of materials, and the need for continued operation of the facility, shall be allowed therefor. Provided that when work involving reconstruction or modernization of storage facilities is undertaken at a location then any required elimination or correction of nonconformity thereat shall be made in the course of such work. Provided, further, however, that where practical difficulties are encountered in accomplishing required elimination of nonconformity at any location, an extension or further extension beyond the time specified in any order therefor may be obtained upon written application to the State Fire Marshal setting forth supporting facts.

103 Approval of Plans for Installation for Storage, Handling or Use of Flammable Liquids

103-01 Except as otherwise provided in paragraph -1 and -2 of this subsection 103-01, before any construction or new or additional installation for the storage, handling or use of flammable liquids is undertaken in bulk plants, service stations and processing plants, drawings or blueprints thereof made to scale shall be submitted to the State Fire Marshal with an application, all in duplicate, for his approval. Within a reasonable time (ten days) after receipt of the application with drawings or blueprints, the State Fire Marshal will cause the same to be examined and if he finds that they conform to the applicable requirements of this Division, as written or as modified pursuant to Section 102 of Division I, shall forthwith signify his approval of the application either by endorsement thereon or by attachment thereto, retain one copy for his files and return to the applicant the other copy plus any additional copies submitted by the applicant. If the drawings or blueprints do not conform to the applicable requirements of this Division as written or as modified as aforesaid, he shall within the time aforesaid notify the applicant accordingly.

103-01-1 If proposed construction or installation is to be located within a

local jurisdiction which requires that a local permit be first obtained, the drawings or blueprints shall be submitted to the appropriate local official or body with the application for permit and then except in case of dispute need not be submitted to the State Fire Marshal. The local official or body, as a condition to the issuance of the permit, shall require compliance with the applicable requirements of this Division as written or as modified pursuant to Section 102 of Division I. In the event of dispute as to whether the drawings or blueprints show conformity with the applicable requirements of this Division as aforesaid the plans and drawings shall forthwith be submitted to the State Fire Marshal whose decision in the matter shall be controlling.

103-02 Drawings shall show the name of the person, firm or corporation proposing the installation, the location thereof and the adjacent streets or highways.

103-03 In the case of bulk plants the drawings shall show, in addition to any applicable features required under paragraphs -05 and -06 of this section, the plot of ground to be utilized and its immediate surroundings on all sides; complete layout of buildings, tanks, loading and unloading docks; type of construction of each building and the type and the location of heating devices therefor, if any.

103-04 In the case of service stations, the drawings, in addition to any applicable features required under paragraphs -05 and -06 of this section, shall show the plot of ground to be utilized; the complete layout of buildings, drives, dispensing equipment, greasing or washing stalls and the type and location of any heating device.

103-05 In the case of aboveground storage, the drawing shall show the location and capacity of each tank; dimensions of each tank the capacity of which exceeds 50,000 gallons; the class of liquid to be stored in each tank; the type of tank supports; the clearances as covered in Sections 202 and 203; the type of venting and pressure relief relied upon and the combined capacity of all venting and pressure relief valves on each tank, as covered in Section 208; the tank control valves as covered in Section 209; and the location of the pumps and other facilities by which liquid is filled into and withdrawn from the tanks.

103-06 In the case of underground storage, the drawings shall show the location and capacity of each tank, class of liquid to be stored therein, together with the clearances and requirements covered in Section 210; and the location of fill, gauge and vent pipes and openings as covered in Section 215.

103-07 In the case of an installation for storage, handling or use of flammable liquids within buildings or enclosures at any establishment or occupancy covered in this Division, the drawings shall be in such detail as will show whether applicable requirements are to be met.

104 Definitions

104-01 "Aircraft Service Station" shall mean that portion of an airport where flammable liquids used as aircraft fuel are stored or dispensed from fixed equipment and shall include all facilities essential thereto.

104-02 "Automotive Service Station" shall mean that portion of a property where flammable liquids used as motor fuels are stored and dispensed from fixed equipment into the fuel tanks of motor vehicles.

104-03 "Bulk Plant" shall mean that portion of a property where flammable liquids are received by tank vessel, pipe lines, tank car, or tank vehicle, and are stored or blended in bulk for the purpose of distributing such liquids by tank vessel, pipe line, tank car, tank vehicle, or container but does not include a refinery.

104-04 "Closed Container" shall mean a container as herein defined, so sealed by means of a lid or other device that neither liquid nor vapor will escape from it at ordinary temperatures.

104-05 "Commercial or Industrial Establishment" shall mean a place wherein the storage, handling, or use of flammable liquids is incidental to but not the principal business or process.

104-06 "Container" shall mean any can, bucket, barrel, drum, or portable tank, except stationary tanks, tank vehicles, and tank cars.

104-07 "Marine Service Station" shall mean that portion of a property where flammable liquids used as motor fuels are stored and dispensed from fixed equipment on shore, piers, wharves, or barges into the fuel tanks of floating craft, and shall include all facilities used in connection therewith.

104-08 "Processing Plant" shall mean that portion of a property in which flammable liquids are mixed, heated, separated or otherwise processed as principal business, but shall not include refineries in which flammable liquids are produced on a commercial scale from crude petroleum, natural gasoline, or other hydrocarbon sources.

104-09 "Safety Can" shall mean an approved portable container, having a spring-closing lid and spout cover.

CHAPTER II

Storage

Part One—Storage Aboveground (Outside of Buildings)

201 Restricted Location

Any approval of plans by the State Fire Marshal shall be subject to compliance with local zoning and restricted fire district regulations.

202 Location with Respect to Property Lines

Location of an aboveground tank for storage of flammable liquids with respect to distance from the nearest line of adjoining property which may be built upon, shall be such that the distance between any part of the tank and the line shall be not less than that set forth in the following:

MINIMUM DISTANCE OF OUTSIDE ABOVEGROUND TANKS FOR FLAMMABLE LIQUIDS OTHER THAN CRUDE PETROLEUM TO IMPORTANT BUILDINGS OR LINE OF ADJOINING PROPERTY WHICH MAY BE BUILT UPON

Capacity of Tank	Class Flammable Liquid	Minimum Distance
0 to 275 gals.	III	0 feet
276 to 750 gals.	III	5 feet
0 to 750 gals.	I and II	10 feet
751 to 12,000 gals.	III	10 feet
751 to 12,000 gals.	I and II	15 feet
12,001 to 24,000 gals.	I, II and III	15 feet
24,001 to 30,000 gals.	I, II and III	20 feet
30,001 to 50,000 gals.	I, II and III	25 feet

Tanks with capacities in excess of 50,000 gallons and all tanks for storage of crude petroleum shall be located in accordance with the following provisions:

GROUP A TANKS. Any all-steel, gas-tight tank constructed in compliance with these or equivalent standards and equipped either with (1) an approved permanently attached extinguishing system or (2) an approved floating roof, which is to be used only for the storage of refined petroleum products or other flammable liquids not subject to boil-over, shall be so located that the dsitance from the line of adjoining property which may be built upon shall

be not less than the greatest dimension of diameter or height of the tank, except that such distance need not exceed 120 feet.

GROUP B TANKS. Any all-steel, gas-tight tank constructed in compliance with these or equivalent standards but not equipped either with (1) an approved permanently attached extinguishing system or (2) an approved floating roof, which is to be used only for the storage of refined petroleum products or other flammable liquids not subject to boil-over, shall be so located that the distance from the line of adjoining property which may be built upon shall be not less than 1½ times the greatest dimension of diameter or height of the tank, except that such distance need not exceed 175 feet.

GROUP C TANKS. Any all-steel, gas-tight tank constructed in compliance with these or equivalent standards and equipped either with (1) an approved permanently attached extinguishing system or (2) an approved floating roof, which is to be used for the storage of crude petroleum, shall be so located that the distance from the line of adjoining property which may be built upon shall be not less than twice the greatest dimension of diameter or height of the tank except that such distance shall be not less than 20 feet and need not exceed 175 feet.

GROUP D TANKS. Any all-steel, gas-tight tank constructed in compliance with these or equivalent standards and not equipped either with (1) an approved permanently attached extinguishing system or (2) an approved floating roof, which is to be used for the storage of crude petroleum shall be so located that the distance from the line of adjoining property which may be built upon shall not be less than three times the greatest dimension of diameter or height of the tank except that such distance shall not be less than 20 feet and need not exceed 350 feet.

202-01 If any adjoining property is used for aboveground tank storage, then the distance between any tank and the line of such adjoining property need be no greater than that necessary to conform to section 203.

203 Spacing Between Tanks

203-01 The location of a tank for the storage of any flammable liquid with respect to any such other tank shall be such that the distance between them shall be not less than 3 feet.

203-02 For tanks above 50,000 gallons individual capacity storing any flammable liquid, except crude petroleum in producing areas, the distance shall be not less than one-half the diameter of the smaller tank.

203-03 In producing areas, for tanks storing crude petroleum and having capacities not to exceed 126,000 gallons (3,000 bbls.) the distance between tanks shall not be less than three feet; in excess of 126,000 gallons (3,000 bbls.), the distance shall not be less than the diameter of the smaller tank.

203-04 The minimum separation between an LP Gas container and a flammable liquid tank shall be 20 feet. Suitable means shall be taken to prevent the accumulation of flammable liquids under adjacent LP Gas containers such as by diking, diversion curbs or grading. When flammable liquid tanks are diked, the LP Gas containers shall be outside the diked area and at least ten feet away from the center line of the dike. The foregoing provisions shall not apply when LP Gas containers of 125 gallons or less capacity are installed adjacent to Class III flammable liquid tanks of 275 gallons or less capacity.

204 Foundations and Supports

Tanks shall rest directly on the ground or on foundations or supports of concrete, masonry, piling, or steel. Exposed piling or steel supports shall be protected by fire-resistive materials to provide a fire-resistance rating of not less than two hours.

204-01 Anchorage: Where a tank is to be located in an area that may be subjected to flooding, compliance with the applicable and generally recognized

protection shall be provided. Precautions outlined in the latest edition of NFPA, No. 30A, Tanks in "Locations Subject to Floods" shall prima facie be deemed to meet the requirements of this sub-section.

205 Stairs, Platforms and Walkways

Stairs, platforms and walkways shall be of steel, concrete or wood.

206 Dikes and Walls

206-01 Crude Petroleum: Tanks or groups of tanks containing crude petroleum shall be diked or other suitable means taken to prevent discharge of liquid from endangering adjoining property or reaching waterways. Where a diked enclosure is required under this section, it shall have a capacity not less than that of the tank or tanks served by the enclosure.

206-02 Flammable Liquids Other Than Crude Petroleum: Individual tanks or groups of tanks, where determined by the State Fire Marshal to be necessary on account of proximity to waterways, character of topography, or nearness to structures of high value, or to places of habitation or assembly, shall be diked or the yard shall be provided with a curb or other suitable means taken to prevent the spread of liquid onto other property or waterways. Where a diked enclosure is required under this section, it shall have a net capacity not less than that of the largest tank plus ten per cent of the aggregate capacity of all other tanks served by the enclosure.

206-03 Dike Construction: Except where protection is provided by natural topography, dikes or retaining walls required under the foregoing section shall be of earth, concrete or solid masonry designed to be liquid tight and to withstand a full hydraulic head, and so constructed as to provide the required protection. Earthen dikes 3 feet or more in height shall have a flat section at the top not less than 2 feet wide. The slope shall be consistent with the angle of repose of the material of which the dikes are constructed. Unless means are available for extinguishing a fire in any tank containing crude petroleum, dikes and walls enclosing such tanks shall be provided at the top with a flareback section designed to turn back a boil-over wave, provided, however, that a flareback section shall not be required for dikes and walls enclosing approved floating roof tanks.

206-04 Drainage: Where provision is made for draining rain water from diked areas, such drains shall normally be kept closed and shall be so designed that when in use they will not permit flammable liquids to enter natural water courses, public sewers, or public drains, if their presence would constitute a hazard.

206-05 No loose combustible material, empty or full drum or barrel, shall be permitted within the diked area.

207 Design and Construction of Tanks Operating at Substantially Atmospheric Pressure

Tanks shall be built of steel or concrete unless character of liquids stored requires other materials. Steel commonly known as "Mill Seconds" shall not be used. Tanks built of materials other than steel shall be designed to specifications embodying safety factors equivalent to those herein specified for steel tanks. Unlined concrete tanks shall only be used for storage of liquids having a gravity of 40 degrees A.P.I. or heavier. Concrete tanks with special linings may be used for other services provided the design is approved by the State Fire Marshal. Steel tanks shall be built in accordance with the requirements of the following paragraphs. All shop-built tanks shall be tested at a pressure of not less than five and not more than ten pounds per square inch (measured at the top of the tank) for a period of at least ten minutes without leakage or permanent deformation.

207-01 Field Erected Vertical Tanks: Vertical tanks erected in the field and built in accordance with the then current edition of American Petroleum Institute Standard No. 12A, "Specifications for Oil Storage Tanks with Riveted

Shells," or of American Petroleum Institute Standard No. 12C, "Specifications for Welded Oil Storage Tanks," shall prima facie be deemed to comply with the requirements of this section.

American Petroleum Institute Standard No. 620, "Rules for the Design and Construction of Large, Welded, Low Pressure Storage Tanks," shall prima facie be deemed to comply with the requirements of this section.

207-02 Small Shop Built Vertical Tanks: Vertical tanks not over 1,100 gallons capacity shall meet the following standards:

Capacity (Gallons)	Minimum Thickness of Steel U. S. Standard
1 — 60	18 gauge
61 — 350	16 gauge
351 — 560	14 gauge
561 — 1,100	12 gauge

207-03 Large Shop Built Vertical Tanks: Vertical tanks over 1,100 gallons capacity shall meet the following standards:

For tanks up to 25 feet in height the shell shall be not less than 3/16 in. thick. For tanks from 25 feet to 30 feet high the bottom ring shall be not less than ¼ in. thick and the remainder of the shell not less than 3/16 in. thick. For tanks between 30 and 35 feet high, the first two rings shall be not less than ¼ in. thick and the remainder of the shell not less than 3/16 in. thick. All ¼ in. thick rings shall be not less than 5 feet wide.

The tops of tanks shall be either dished or cone-shaped and of not less than No. 10 U. S. Standard gauge steel.

Tanks shall be welded, or riveted and caulked, or otherwise made tight in a workmanlike manner. The roof of the tank shall be securely fastened to the top ring of the shell with a joint having the same tightness as the joints between rings. The joint between roof and shell shall be weaker than any other joints in the shell of the tank. Joints in the roof shall be welded or riveted or made tight by other process. Roofs of tanks shall have no unprotected openings.

207-04 Production Tanks: Vertical tanks not exceeding 126,000 gallons (3,000 bbls.) individual capacity, when used for crude petroleum storage in oil producing areas, shall be deemed prima facie evidence of compliance with this section when built in accordance with applicable requirements of the then current edition of American Petroleum Institute Standard No. 12B, "Specifications for Bolted Production Tanks," or Standard 12D, "Specifications for Large Welded Production Tanks," or Standard 12F, "Specifications for Small Welded Production Tanks."

207-05 Shop Built Horizontal Tanks: Horizontal tanks shall be constructed in accordance with accepted engineering practice and shall meet the following minimum requirements: Joints shall be riveted and caulked, riveted and welded, or welded. Tank heads over 6 feet in diameter shall be dished, stayed, braced, or reinforced.

207-05-1 Small Shop Built Horizontal Tanks: Horizontal tanks not over 1,100 gallons capacity shall meet the following standards:

Capacity (Gallons)	Minimum Thickness of Steel U. S. Standard
1 to 60	18 gauge
61 to 275	14 gauge
276 to 550	12 gauge
551 to 1,100	10 gauge

207-05-2 Large Shop Built Horizontal Tanks: Horizontal tanks over 1,100 gallons capacity having a diameter of not over 6 feet made of steel shall be 3/16 in. or greater nominal thickness. Tanks having a diameter of over 6 feet and not more than 12 feet, made of steel, shall be ¼ in. or greater nominal thickness.

208 Vents

208-01 Normal Breathing: Tanks shall have normal venting capacity sufficient to permit the filling and emptying of such tanks, plus their breathing due to temperature changes, without distortion of tank shell or roof. Tanks storing Class I and Class II flammable liquids shall be equipped with either venting devices which shall be normally closed when not under pressure or vacuum, or with approved flame arresters, except that tanks under 2,500 gallons capacity for Class I liquids and tanks under 3,000 barrels capacity for crude oil in producing areas may have open vents.

208-02 Emergency Relief: Every aboveground storage tank shall have some form of construction or device that will relieve excessive internal pressure, caused by exposure fires, that might cause the rupture of the tank shell or bottom. In a vertical tank, this construction may take the form of a weakened seam in the roof. The joint between the roof and the shell of a tank 36 feet or more in diameter, if built in accordance with Section 207-01, shall be deemed to be a weakened seam for this purpose. Where entire dependence for such additional relief is placed upon some device other than a weak roof seam or joint, the total venting capacity of both normal and emergency vents shall be enough to prevent rupture of the shell or bottom of the tank if vertical, or of the shell or heads if horizontal. Such device may be a self-closing manhole cover, or one using long bolts that permits the cover to lift under internal pressure, or an additional or larger relief valve or valves. For the purpose of computing the number and area of such vents and emergency relief devices, reference may be made to the table, Required Total Pressure Relief Capacity of Vents.

208-03 The outlet of all vents and vent drains on tanks designed for 15 lbs. per square inch or greater pressure shall be arranged to discharge in such a way as to prevent localized overheating of any part of the tank, in the event vapors from such vents are ignited.

REQUIRED TOTAL PRESSURE RELIEF CAPACITY OF VENTS

Capacity of Tank		Total Pressure Relief Capacity	Approximate Diameter in Inches of Free Circular Opening for Various Pressures			
Gallons	42-Gallon Barrels	(Cu. Ft. of Free Air Per Hour)	3 In. of Water	1 PSI	2½ PSI	5 PSI
1,000 or less	23.8	25,300	4	2½	2	1½
4,000	95.2	69,500	6¾	3¾	3	2½
18,000	428	139,000	9½	5½	4¼	3¾
25,000	595	166,000	10¼	6	4¾	4
56,000	1,330	253,000	12¾	7¼	5¾	5
100,000	2,380	363,000	15¼	8¾	7	6
155,000	3,690	458,000	17¼	9¾	7¾	6½
222,000	5,290	522,000	18¼	10½	8¼	7
475,000	11,300	624,000	20	11¼	9	7¾
735 000	17,500	648,000	20	11½	9¼	7¾
Unlimited		648,000	20	11½	9¼	7¾

209 Tank Valves

209-01 External Valves: Each connection to an aboveground tank storing flammable liquids, located below normal liquid level, shall be provided with an external control valve located as close as practicable to the shell of the tank. Except for flammable liquids whose chemical characteristics are incompatible with steel, such valves and their tank connections installed after effective date of these regulations shall be of steel.

209-02 Emergency Internal Check Valves: In addition to any normal valves, there must be an extra valve at each pipe line connection to any tank below normal liquid level, which valve is effective inside the tank shell and is

operated both manually and by an effective heat actuated device which, in case of fire, will automatically close the valve to prevent the flow of liquid from the tank even though the pipe lines are broken from the tank. These extra valves are not required in crude oil tanks in oil fields, on tanks at refineries, or on tanks at terminals which are equipped with a swing line or where facilities are provided to transfer the contents of the tank to another tank in case of fire.

Part Two—Storage Underground or in Buildings

210 Underground; Outside of or Under Buildings

210-01 Location: A flammable liquids storage tank may be located underground, outside of or under a building, if such installation meets the requirements of this section. The tank shall be so located with respect to existing building foundations and supports that the loads carried by the latter cannot be transmitted to the tank. The distance from any part of a tank storing Class III liquids to the nearest wall of any basement, pit, cellar, or property line shall be not less than one foot. The distance from any part of a tank storing Class I or II liquids to the nearest wall of any basement, pit, or cellar shall be not less than one foot, and from any property line that may be built upon, not less than three feet.

210-02 Depth and Cover: Excavation for underground storage tanks shall be made with due care to avoid undermining of foundations of existing structures. Underground tanks shall be set on firm foundation and surrounded with soft earth or sand well tamped in place. Tanks shall be covered with a minimum of two feet of earth, or shall be covered with not less than one foot of earth, on top of which shall be placed a slab of reinforced concrete not less than four inches thick. When underground tanks are or are likely to be subjected to traffic, they shall be protected against damage from vehicles passing over them by at least three feet of earth cover, or 18 inches of well-tamped earth, plus six inches of reinforced concrete or eight inches of asphaltic concrete. When asphaltic or reinforced concrete paving is used as part of the protection, it shall extend at least one foot horizontally beyond the outline of the tank in all directions.

210-03 Anchorage: Where a tank may become buoyant due to a rise in the level of the water table or due to location in an area that may be subjected to flooding, suitable and generally recognized protection shall be provided to anchor the tank in place. Compliance with the applicable precautions outlined in the then current edition of NFPA Standard No. 30A shall prima facie be deemed to meet the requirements of this sub-section.

211 Inside of Buildings, Class I and II Liquids

Tanks for storage of Class I and II flammable liquids shall not be installed inside buildings except as provided under Chapters V, VI and VII of this division. Tanks for storage of Class I and II flammable liquids may be installed under a building as an underground tank complying with Section 210.

212 Inside of Buildings, Class III Liquids

212-01 Unenclosed tanks shall not be located within 5 feet, horizontally, of any fire or flame.

212-02 Tanks larger than 60 gallons capacity shall not be located in buildings above the lowest story, cellar or basement, except in commercial, industrial or processing plants where storage on a higher floor is required by the process.

212-03 Tanks exceeding 550 gallons individual capacity or 1,100 gallons aggregate capacity in an individual building or in a section of a building separated by firewalls shall be installed in an enclosure constructed as follows: The walls of the enclosure shall be constructed of reinforced concrete at least 6 in. thick or of brick at least 8 in. thick. Such enclosures shall be installed only on concrete or other fire-resistive floors and shall be bonded to the floors. Enclosures shall have tops of reinforced concrete at least 5 in. thick or equivalent fire-resistive construction, except that where floor or roof construction above

the enclosure is concrete or other fire-resistive construction, the walls may be extended to and bonded to the underside of the construction above in lieu of the provision of a separate top. Any openings to such enclosures shall be provided with fire doors or other approved closures and six-inch noncombustible liquid-tight sills or ramps. Provision shall be made for adequate ventilation of such enclosures prior to entering for inspection or repairs to tanks.

212-04 In buildings of ordinary construction, the nominal gross capacity of tanks shall not exceed 10,000 gallons. In fire-resistive buildings the nominal gross capacity of the tanks shall not exceed 15,000 gallons. In any building, if in a fire-resistive or detached room cut off vertically and horizontally in an approved manner from other floors of the main building, the nominal gross capacity of tanks shall not exceed 50,000 gallons, with an individual tank capacity not exceeding 25,000 gallons.

213 Design and Construction of Tanks

213-01 Underground Tanks or Enclosed Tanks Inside of Buildings: Tanks shall be designed and constructed to withstand safely the service to which subjected. Material other than steel, if used, shall be of suitable durability and of thickness providing equivalent strength to that provided by steel. Steel commonly known as "mill seconds" shall not be used. Steel tanks shall be of a minimum gauge (U. S. Standard) in accordance with the following table:

Capacity (Gallons)	Minimum Nominal Thickness of Material U. S. Standard Gauge	Pounds per Square Foot
1 to 285	No. 14	3.125
286 to 560	No. 12	4.375
561 to 1,100	No. 10	5.625
1,101 to 4,000	No. 7	7.50
4,001 to 12,000	1/4 in.	10.00
12,001 to 20,000	5/16 in.	12.50
20,001 to 30,000	3/8 in.	15.00

If adequate internal bracing is provided, tanks of 12,001 to 30,000 gallons capacity may be built of ¼ in. plate.

213-02 Unenclosed Tanks Inside of Buildings: Tanks of this category used for Class III flammable liquids shall not exceed 275 gallons individual capacity. They may be cylindrical or of a special form which has been demonstrated by appropriate tests to possess strength and tightness of an acceptable degree. Material other than steel, if used, shall be of suitable durability and thickness to provide strength equivalent to that provided by steel. Steel commonly known as "mill seconds" shall not be used. Steel tanks shall be of a minimum gauge (U. S. Standard) in accordance with the following table:

Capacity (Gallons)	Minimum Nominal Thickness of Material U. S. Standard Gauge	Pounds per Square Foot
1 to 180	No. 16	2.50
181 to 275	No. 14	3.125

214 Support of Tanks in Buildings

Inside storage tanks shall be securely supported to prevent settling, sliding or lifting.

215 Tank Connections for Tanks Underground or in Buildings

215-01 Vents:

215-01-1 Location and Arrangement of Vents—Class I or II: Vent pipes from tanks storing Class I or Class II flammable liquids shall be so located that the discharge point is outside of buildings, higher than the fill pipe opening, and not less than 12 feet above the adjacent ground level. Vent pipes shall discharge

only upward or horizontally (not downward) in order to disperse vapors. Vent pipes 2 in. or less in nominal inside diameter shall not be obstructed by devices that will reduce their capacity and thus cause excessive back pressure. Vent pipe outlets shall be so located that flammable vapors will not enter building openings, or be trapped under eaves or other obstructions. If the vent pipe is less than 10 feet in length or greater than 2 in. in nominal inside diameter, the outlet shall be provided with a vacuum and pressure relief device or there shall be an approved flame arrester in the vent line at the outlet or within the approved distance from the outlet. In no case shall a flame arrester be located more than 15 feet from the outlet end of the vent line.

215-01-2 Location and Arrangement of Vents—Class III: Vent pipes from tanks storing Class III flammable liquids shall terminate outside of building and higher than the fill pipe opening. Vent outlets shall be above normal snow level. They may be fitted with return bends, coarse screens or other devices to minimize ingress of foreign material.

215-01-3 Size of Vents: Each tank shall be vented through piping adequate in size to prevent blow-back of vapor or liquid at the fill opening while tank is being filled. Vent pipes shall be not less than 1¼ in. nominal inside diameter.

215-01-4 Vent Piping: Vent pipes shall be so laid as to drain toward the tank without sags or traps in which liquid can collect. They shall be located so that they will not be subjected to physical damage above ground. Vent pipes from tanks storing the same class of flammable liquids may be connected into one outlet pipe. The outlet pipe shall at least be one pipe-size larger than the largest individual vent pipe connected thereto. In no case shall the point of connection between vent lines be lower than the top of any fill-pipe opening. The lower end of a vent pipe shall enter the tank through the top and shall not extend into the tank more than 1 inch.

215-02 Fill and Discharge Piping: Filling and discharge lines for Class I and Class II liquids, and for Class III liquids where practicable, shall enter tanks only through the top and shall be graded toward the tank.

215-03 Fill Openings: The fill pipe opening shall be located outside of any building. For Class I or Class II flammable liquid storage the fill pipe opening shall be not less than 5 feet from any door or cellar opening. For Class III flammable liquid storage the fill pipe opening shall be not less than 2 feet from any building opening at the same or lower level. The fill-pipe opening shall be closed and liquid-tight when not in use. Fill-pipe for filling by tank car or tank truck shall be not larger than 4 in. nominal inside diameter and shall not be constricted. Fill-pipe openings shall be identified by a definite color scheme or other means.

215-04 Gauge Openings: Gauge openings, if independent of fill-pipe, shall be provided with liquid-tight cap or cover. Where Class I or Class II liquids are stored within a building, such gauge opening shall be protected against vapor release or liquid overflow by means of a spring-loaded check valve or other approved device.

215-05 Drainage of Tanks in Buildings: Inside storage tanks for Class III flammable liquids shall be provided with draw-off or drain openings. Tanks shall be installed so that the bottom pitches to the draw-off or drain openings at a slope of not less than ¼ in. per foot of length. The draw-off or drain openings shall be provided with suitable connection to provide a sump from which water or sediment can be drained readily.

216 Testing

Before being covered or placed in use, tanks and piping connected thereto must pass a test for tightness. Where the vent outlet is not more than 15 feet above the top of the tank the test pressure shall be at least 5 psi and either air or hydrostic pressure may be used. Where the vent outlet is more than 15

feet above the top of the tank the test shall be made under hydrostatic pressure with the vent line flooded. In special cases where the height of the vent above the top of the tank is excessive the hydrostatic test pressure shall be specified by the State Fire Marshal.

Part Three—Storage in Closed Containers Inside Buildings

217 Scope

217-01 Part Three applies to the storage of flammable liquids in drums or other portable closed containers not exceeding 60 gallons individual capacity in areas used solely for such storage. These requirements do not apply to the occupancies detailed in Chapters IV, V, VIII and IX.

218 Design and Construction of Inside Storage Rooms

218-01 Inside Storage Rooms shall comply with the following general construction requirements: Walls, floors and ceilings shall be of noncombustible construction having a fire-resistive rating of not less than two hours. Openings to other rooms or buildings shall be provided with noncombustible liquid-tight raised sills or ramps at least six inches in height and with fire doors with heat actuated releasing devices arranged to close doors automatically in case of fire. Where other portions of the building or other properties are exposed, windows shall be protected in a standard manner. No combustible material shall be used in the construction of shelving. Proper ventilation shall be provided and natural ventilation is preferred over mechanical ventilation. Heating shall be restricted to low pressure steam or hot water or to electrical units approved for Class I hazardous locations.

218-02 Electrical devices located in Inside Storage Rooms used for Class I or Class II Flammable Liquids shall be approved for Class I, Division II Hazardous Locations and for Class III Flammable Liquids, shall be equipment for general use. Compliance with provisions of the "National Electrical Code" as published by the NFPA shall be deemed prima facie evidence of compliance with this section.

218-03 Rooms or portions of buildings, affording a type of building construction and other features equivalent to that required for Inside Storage Rooms (218-01 and 218-02) may be utilized for storage of flammable liquids if not used for any other storage or operation which, in combination, create a greater fire hazard.

218-04 Storage rooms shall be located to minimize damage in the event of an explosion.

218-05 It is recommended that roofs of detached buildings, and where practical the roofs or ceilings of all Inside Storage Rooms, be equipped with large vents so that if a fire occurs the heat will be dissipated to the out of doors.

219 Storage Cabinets

219-01 Storage cabinets may be used where it is desired to keep more than ten gallons of flammable liquids inside buildings. No individual container shall exceed five gallons capacity and not over 50 gallons shall be stored in any one cabinet.

219-02 Storage cabinets shall be constructed as follows or built to equivalent requirements. The bottom, top, door and side of cabinet shall be at least No. 18 gauge sheet iron and double walled with 1½-inch air space. Joints shall be riveted, welded or made tight by some equally effective means. The door shall be provided with a 3-point lock, kept closed when not in use. and the door sill shall be raised at least two inches above the bottom of the cabinet. When deemed necessary by the State Fire Marshal, cabinets shall be vented. The cabinet shall be conspicuously labeled in red letters "FLAMMABLE—KEEP FIRE AWAY."

220 Manner of Storage and Limitations

220-01 Flammable liquids shall not be stored (including stock for sale), near exits, stairways or areas normally used for the safe egress of people.

220-02 The storage of flammable liquids in closed containers shall comply with the following occupancy schedule except that the State Fire Marshal may impose a quantity limitation or require greater protection where, in his opinion, unusual hazard to life or property is involved, or he may authorize increase of these amounts where the type of construction, fire protection provided or other factors substantially reduce the hazard.

220-02-1 In a mixed occupancy, where any occupancy involves the storage of flammable liquids, that occupancy or that portion of the occupancy devoted to flammable liquid storage, in addition to other requirements, shall be cut off by at least two-hour fire-resistive construction.

220-02-2 One, Two and Three Family Dwellings and Accompanying Attached or Detached Garages: Storage other than fuel oil, prohibited, except that which is required for maintenance or equipment operation which shall not exceed ten gallons. Such flammable liquid shall be stored in metal closed containers or safety cans.

220-02-3 Public Assemblies, Apartments, Hotels, Theatres and Office Buildings: Storage prohibited, except that which is required for maintenance and operation of building and operation of equipment. Such storage shall be kept in closed metal containers stored in a storage cabinet or in safety cans or in an Inside Storage Room not having a door that opens into that portion of the buildings used by the public.

220-02-4 Schools, Hospitals and Institutional Buildings: Storage shall be limited to that required for maintenance, demonstration, treatment and laboratory work and shall be in an Inside Storage Room preferably at ground level with at least one exterior wall. Flammable liquids in the laboratories, etc., shall be in small containers (quart or less) or in safety cans or in storage cabinets.

220-02-5 Retail Stores and Department Stores: In rooms or areas accessible to the public, storage shall be in closed containers and limited to quantities needed for display and normal merchandising purposes. Additional stocks shall be stored in rooms or portions of buildings that comply with the construction requirements of Section 218.

220-02-6 General Purpose and Public Warehouses: Storage shall be in fire-resistive buildings or in portions of such buildings cut off by standard fire walls. Noncombustible material, creating no hazard to the flammable liquids, may be stored in the same area.

220-02-7 Flammable Liquid Warehouses or Storage Buildings: Storage shall be in accordance with Paragraph 220-02-8. Maximum allowable storage is dependent upon the type of construction of the building, fire protection and drainage provided and potential fire exposure to other important buildings. If storage building is located 30 to 50 feet from important building or line of property which may be built upon, the exposing wall shall be a blank wall having a fire-resistance rating of at least two hours. If storage building is located 10 to 30 feet from line of property which may be built upon, the exposing wall shall be a blank wall having a fire-resistance rating of at least three hours. If storage building is less than ten feet from the line of adjoining property which may be built upon, the exposing wall shall be a blank wall having a fire-resistance rating of at least four hours. At the discretion of the State Fire Marshal approved Class A fire doors may be installed in a standard manner on the otherwise blank walls.

220-02-8 Flammable liquid containers shall be stored in accordance with safe practice, in tiers or piles of such height and width and separated by aisles of such width as will permit the free movement of materials and material handling equipment in and out of the storage area. A main aisle of 8 feet in

width and storage otherwise in conformity with the following table shall prima facie be deemed safe practice.

SPRINKLERED OR EQUIVALENT PROTECTION

		Maximums Per Pile			
		TOTAL Gallons	**WIDTH Feet**	**HEIGHT Feet**	**Min. Width, Side Aisle Feet**
CLASS I	Ground & Upper Floors	2,640 (48)	8 (4)	6 (2)	5
	Bsmt.*	0	0	0	
CLASS II	Ground & Upper Floors	5,280 (96)	8 (4)	6 (2)	4
	Bsmt*	1,320 (24)	4 (2)	3 (1)	
CLASS III	Ground & Upper Floors	11,000 (200)	12 (6)	3 ft. under sprinkler heads	4
	Bsmt*	5,500 (100)	8 (4)	9 (3)	

UNPROTECTED

		Maximums Per Pile			
		TOTAL Gallons	**WIDTH Feet**	**HEIGHT Feet**	**Min. Width, Side Aisle Feet**
CLASS I	Ground & Upper Floors	660 (12)	4 (2)	3 (1)	7
	Bsmt.*	0	0	0	
CLASS II	Ground & Upper Floors	1,320 (24)	4 (2)	3 (1)	5
	Bsmt*	0	0	0	
CLASS III	Ground & Upper Floors	2,640 (48)	8 (4)	12 (4)	4
	Bsmt.*	660 (12)	4 (2)	3 (1)	

*Basement means a story of a building or structure having one-half or more of its height below ground level and to which access for fire fighting purposes is unduly restricted.

The figures in the column, Total Gallons, represent the number of gallons that may be stored per pile and the figures in parenthesis are the corresponding number of 55 gallon drums. The figures in the Width and Height Columns are the width and height of the pile in feet and the figures in parenthesis are the corresponding number of 55 gallon drums when stored on end that will produce this size pile.

Nothing in the foregoing table or the provisions of this section with reference thereto shall prohibit storage in tiers or piles of greater width and height and with lesser width aisles, where by reason of the type of construction of the building or clearances of adjoining occupancy no substantial exposure hazard exists.

221 Fire Control

221-01 Suitable fire-control devices, such as small hose or first aid fire appliances, shall be available at locations where fires are likely to occur.

221-02 When sprinkler or equivalent protection is required, it shall be installed in an approved manner. Sprinkler installations made in accordance with the then current edition of the Standards of the National Fire Protection Association for Sprinkler Systems (NFPA No. 13), shall be deemed prima facie evidence of compliance with the section.

221-03 Open flames, smoking and other sources of ignition shall not be permitted in flammable liquid storage rooms.

221-04 Materials which will react with water to produce flammable vapors shall not be stored in the same room with flammable liquids.

Part Four—Storage in Closed Containers Outside Buildings

222 Scope

222-01 Part four applies to the storage of flammable liquids in drums or other portable closed containers not exceeding 60 gallons individual capacity in areas used solely for such storage. These requirements do not apply to the occupancies detailed in Chapters IV, V, VIII and IX.

223 Basic Safeguards

223-01 Drums constructed in accordance with ICC Specifications or containers of equivalent construction may be stored out of doors.

223-02 Drums shall not be stored outside on building platforms or between buildings, or in locations adjacent thereto, in such a manner that they would contribute to the spread of fire from one building to another.

223-03 Storage of over 100 drums of Class I or II flammable liquids shall be limited to groups of 100 drums, located at least 60 feet from the nearest important building or line of adjoining property that may be built upon and each group shall be separated by at least 40 feet. Storage of over 300 drums of Class III flammable liquids shall be limited to groups of 300 drums located at least 50 feet from nearest building or line of adjoining property that may be built upon and each group shall be separated by at least 30 feet. These distances may be reduced 50 per cent if sprinklers and drainage away from exposures are provided.

223-04 The drum storage shall be located to prevent "run-off" or drainage toward other storage or buildings. The area shall be kept clear of grass, weeds and other foreign combustibles. Signs shall be posted prohibiting open flames and smoking.

CHAPTER III

Piping, Valves and Fittings

301 Materials and Design

Piping, valves, and fittings for flammable liquids shall be designed for the working pressures and structural stresses to which they may be subjected. They shall be of steel or other material suitable for use with the liquid being handled. Pipe wall thicknesses determined in accordance with Section 3 of the American Standard Code for Pressure Piping (ASA B31.1) shall be deemed prima facie evidence of compliance with this section; except that carbon steel pipe shall not be thinner than Standard Wall thickness listed in the American Standard for Wrought-Steel and Wrought-Iron pipe (ASA B36.10). All threaded joints and connections shall be made up tight with suitable lubricant or piping compound.

302 Protection Against Corrosion

All piping for flammable liquids, both aboveground and underground, where subject to external corrosion, shall be painted or otherwise protected.

303 Supports

Pipe systems shall be substantially supported and protected against physical damage and excessive stresses arising from settlement, vibration, expansion or contraction.

304 Valves

Pipe systems shall contain a sufficient number of valves to operate the system properly and to protect the plant. Pipe systems in connection with pumps shall contain a sufficient number of valves properly to control the flow of liquid in normal operation and in the event of physical damage. Connections to piping, by which equipment such as tank cars or tank trucks discharge flammable liquids by means of centrifugal pumps into aboveground storage tanks, shall be provided with check valves for automatic protection against back-flow.

305 Pumps and Piping

305-01 In intra-plant systems, pump or piping connected for handling Class I or Class II liquids shall not be so connected or manifolded as to permit their intermittent or alternate use for Class III liquids.

305-02 The piping shall have a definite scheme of identification such as, stenciling, tagging or coloring of either the lines or the control valves or both to distinguish the class of product which is being carried by each line.

305-03 Pumps delivering to or taking supply from tanks or tank car shall be provided with valves on both suction and discharge of pump.

305-04 Paragraphs -01, -02 and -03 of this Section 305 do not apply to pipe line systems operating between or within refineries, boat or barge docks, marine terminals or pipe line terminals or tank farm storage adjunctive thereto.

CHAPTER IV

Bulk Plants

401 Location of Plants

401-01 Any approval of plans by the State Fire Marshal shall be subject to compliance with local zoning and restricted fire district regulations.

402 Storage

402-01 Storage—Class I or II: Class I and Class II flammable liquids shall be stored in closed containers, or in storage tanks aboveground outside of buildings, or underground. (See Chapter II of this division.)

402-02 Storage—Class III: Class III flammable liquids shall be stored in containers, or in tanks within buildings or aboveground outside of buildings, or underground. (See Chapter II of this division.)

402-03 Storage of Containers: Containers of flammable liquids when piled one upon the other shall be separated by dunnage, sufficient to provide stability and to prevent excessive stress on container walls. The height of piles shall be consistent with stability and strength of containers.

403 Filling and Emptying Containers

403-01 Containers of Class I or Class II flammable liquids shall not be drawn from or filled within buildings unless provision is made to prevent the accumulation of flammable vapors in hazardous concentrations.

403-02 Except when packaged in the original sealed container as put up for package sale or distribution by the manufacturer or packager with suitable

and generally recognized precautionary labeling or when packaged and labeled for shipment in conformity with the regulation of the Interstate Commerce Commission, no gasoline or benzene nor any naptha having a flash point at or below 70°F. (closed cup tester) shall be filled into any drum, can or other portable container unless the container is of metal and is colored red and labelled with the common name of the product and with the word "FLAMMABLE."

404 Ventilation

Ventilation shall be provided for all rooms, buildings, or enclosures in which Class I or Class II flammable liquids are pumped or dispensed. Design of ventilation systems shall take into account the relatively high specific gravity of the vapors. Ventilation may be provided by adequate openings in outside walls at floor level unobstructed except by louvers or coarse screens. Where natural ventilation is impracticable, mechanical ventilation shall be provided. Mechanical systems, for removing flammable vapors, designed, installed and operated in accordance with National Fire Protection Association standards for the "Installation of Blower and Exhaust Systems" published in National Fire Codes, Vol. III, shall be deemed prima facie evidence of compliance with this section.

405 Buildings

405-01 General Construction: Buildings shall be constructed so that rooms in which flammable liquids are handled or stored comply with the requirements of the zone or area in which located. Class I and Class II flammable liquids shall not be stored or handled within a building having a basement or pit into which flammable vapors may travel, unless such area is provided with ventilation designed to prevent the accumulation of flammable vapors therein.

405-02 Exits: Rooms storing flammable liquids or in which flammable liquids are handled by pumps shall have exit facilities arranged to prevent occupants being trapped in the event of fire.

405-03 Heating: Rooms in which Class I or Class II flammable liquids are stored or handled shall be heated only by means not constituting a source of ignition, such as steam or hot water. Rooms containing heating appliances involving sources of ignition shall be located and arranged to prevent entry of flammable vapors.

406 Loading and Unloading Facilities

406-01 Truck Loading Racks:

406-01-1 Location: Truck loading racks installed after effective date of these regulations dispensing Class I or Class II flammable liquids shall where practicable be separated from tanks, warehouses, other plant buildings, and nearest line of property that may be built upon by a clear distance of not less than 25 feet, measured from the nearest position of any fill stem. With reference to Section 102, in no case shall a truck loading rack for Class I or II liquids be or be rebuilt nearer than 10 feet measured as aforesaid from any of the aforementioned objects. Buildings for pumps or for shelter of loading personnel may be part of the loading rack.

406-01-2 Static Protection: The following types of truck loading racks shall be equipped with protection against static sparks during truck filling:—racks dispensing Class I or Class II flammable liquids into open domes of tank trucks, and racks dispensing Class III flammable liquids into open domes of tank trucks which may contain flammable vapors from previous cargoes of Class I or Class II flammable liquids. Protection shall consist of a metallic bond-wire permanently electrically connected to the fill-stem or some part of the fill-stem piping. The free end of such wire shall be provided with a clamp or similar device for convenient attachment to some metallic part of the cargo tank of the tank truck. The bond-wire connection shall be made prior to opening the dome covers. It shall be maintained in place during the entire filling operation and the dome covers shall be securely closed before the bond-wire is disconnected from the cargo tank.

406-02 Tank Car Racks: Class I and Class II flammable liquids shall not be discharged from or loaded into tank cars unless protection against stray currents has been provided and is used. Protection designed and installed in accordance with Circulars of the Association of American Railroads, No. 17-D, and No. 17-E, shall be deemed prima facie evidence of compliance with this section.

406-02-1 No Unloading by Gravity: The withdrawal of Class I or Class II liquids from tank cars through bottom outlets shall not be permitted.

406-02-2 The use of compressed air to discharge contents of tank cars is prohibited, but this shall not be construed to prevent the use of a standard system employing an inert gas, such as carbon dioxide or nitrogen, as pressure generating medium for this purpose.

406-02-3 No Unloading to Portable Containers: Unloading from tank cars to tank trucks or to any other portable container shall not be permitted.

406-02-4 Tank cars shall not be left connected to pipe lines except when loading or unloading is going on, and during all such time a competent man shall be present and in charge.

406-03 Container Filling Facilities: Class I and Class II flammable liquids shall not be run into containers unless the nozzle and container are electrically interconnected. Where the metallic floorplate on which the container stands while filling is electrically connected to the fill stem or where the fill stem is bonded to the container during filling operations by means of a bond-wire, the provisions of this section shall be deemed to have been complied with.

406-04 Drainage and Waste Disposal: Provision shall be made to prevent flammable liquids which may be spilled at loading or unloading points from entering public sewers and drainage systems, or natural waterways. Connection to such sewers, drains, or waterways by which flammable liquids might enter shall be provided with separator boxes or other approved means whereby such entry is precluded. Crankcase drainings and flammable liquids shall not be dumped into sewers, but shall be stored in tanks or tight drums outside of any building until removed from the premises.

407 Electrical Equipment

All wiring and electrical equipment including motors and electrical switch gear for pumps handling Class I or Class II flammable liquids and located within the possible path of vapor travel shall be designed and installed so as not to create an ignition hazard. Electrical equipment designed and installed in accordance with the then current edition of Standards known as the "National Electrical Code" as published by the National Fire Protection Association, shall be prima facie deemed to be in compliance with this section.

408 Sources of Ignition

Class I or Class II flammable liquids shall not be handled, drawn, or dispensed where flammable vapors may reach a source of ignition. Smoking shall be prohibited except in designated locations. "NO SMOKING" signs shall be conspicuously posted where hazard from flammable liquids vapors is normally present.

409 Fire Control

Suitable first-aid fire-control devices, such as smothering agents, small hose or portable extinguishers, shall be available to locations where fires are likely to occur.

410 Care and Attendance of Property

410-01 Property shall be kept free from weeds, high grass, rubbish and litter, and shall be kept neat, clean and orderly throughout.

CHAPTER V

Service Stations

501 Location, Construction, Heating

Any approval of plans by the State Fire Marshal shall be subject to compliance with local zoning regulations.

Apparatus dispensing Class I flammable liquids into the fuel tanks of motor vehicles of the public shall not be located at a bulk plant unless separated by a fence or similar barrier from the area in which bulk operations are conducted.

501-01 General Construction: Buildings shall be constructed so that rooms in which flammable liquids are handled or stored comply with the requirements of the zone or area in which located. Class I and Class II flammable liquids shall not be stored or handled within a building having a basement or pit into which flammable vapors may travel, unless such area is provided with ventilation designed to prevent the accumulation of flammable vapors therein.

501-02 Building:

501-02-1 No basement or excavation shall hereafter be constructed under any service station building. Steps shall be taken to eliminate existing basements upon the occasion of any major remodeling of a service station. This restriction shall not apply to garages.

501-02-2 Floor shall preferably be of concrete or other fire resisting materials.

501-03 Service Pits:

501-03-1 Except as otherwise provided in 501-03-3, no service station or filling station shall be constructed or remodeled after the effective date of these regulations in such a manner as to include a service pit.

501-03-2 Service pits existing as of the effective date of these regulations shall comply with the following:

(1) No sewer connection shall be permitted from any pit, unless protected with an approved grease trap which will effectively intercept greases and oils, and prevent their entry into the sewer.

(2) If service pits are electrically lighted, lights and switches shall be of explosion proof construction and wiring in conduit.

501-03-3 In an establishment where greasing or other services are to be regularly rendered to vehicles of such type, size or weight or for other good reason it would be impracticable to utilize ramp or hoist type equipment for these services, a pit may be installed but only after written approval from the State Fire Marshal upon application in writing accompanied by plans and specifications for the proposed installation. Every such approval shall be on the condition that the proposed installation be constructed and maintained in conformity with the following requirements:

(1) Each pit must be constructed of poured concrete.

(2) All electric wiring and electric equipment in each pit or used in connection therewith must be explosion proof and all such equipment shall bear the Underwriters Laboratories label.

(3) Each pit must be equipped with a mechanical exhaust system capable of exhausting five cubic feet of air per minute per square foot of floor area within the pit and shall have a capacity of not less than 1,400 cubic feet per minute. The exhaust system shall be wired electrically so that the system will be in full operation when pit lights are lighted.

(4) The discharge from the exhaust system shall be to the outside atmosphere and located in such a manner that the exhaust air will not re-enter the building.

(5) No sewer connection shall be permitted from any pit, unless protected with an approved grease trap which will effectively intercept greases and oils, and prevent their entry into the sewer.

501-04 Heating and Lighting:

501-04-1 Except as otherwise provided in this section, heating stoves, space heaters, and furnaces or other heating plants shall not be installed or used in a Service Station Building, in which motor vehicles are greased, serviced or stored.

501-04-2 Except as hereinafter provided, Service Stations which have a room or stall for greasing, servicing or storing motor vehicles, shall be heated by means of radiation or connections from hot water vapor, or steam heating systems, of which both the boilers or devices containing combustion chambers and fuel storage shall be installed in a separate heater room. Said heater room shall be cut off from the remainder of the building by standard fire division walls of at least two hours fire-resistive construction extending from the foundation to the roof of building. Provided said walls are contained as a parapet wall to a height of not less than three feet above the roof, ceiling of heater room may be of ordinary construction. In the event said walls are not continued as a parapet wall as herein provided, the ceiling shall be one hour fire-resistive construction.

There shall be no openings in the above mentioned standard fire division walls except those necessary for hot air, hot water, vapor or steam heating pipes.

The only entrance to heater room shall be from outside of building.

501-04-3 The following types of heating installations are acceptable without enclosure in a separate heater room.

(1) Oil or gas fired warm air furnaces consisting of burners within enclosed combustion chamber, motor driven air circulating fans, and safety controls, suspended from ceilings or mounted between uprights and installed at a minimum height of seven feet above the floor. Unless installed in conformity with requirements under which "approved" or in conformity with applicable standards of the National Fire Protection Association, said furnaces shall maintain minimum spacings from combustible walls and ceilings as follows: Sides and rear 6"; above 6"; burner side 48"; flue pipe 18".

(2) Gas fired unit heaters which have their flame protected from drafts of air and contact with combustible materials, consisting essentially of burners with enclosed combustion chambers, flue, air circulating motor driven fans, safety controls, designed to be suspended from ceilings or mounted between uprights and installed at least 7 feet above the floor, and (unless installed in conformity with requirements under which "approved" or in conformity with applicable standards of the National Fire Protection Association) maintaining minimum spacing to combustible walls from the casing of the unit heater as follows: Sides and rear 6"; above 6"; flue pipe 9".

(3) Electrical unit heaters constructed and installed to conform to the then current edition of Underwriters Laboratories, Incorporated, "Standard for Electric Heating Appliances."

Heating Units permitted in Sections 501-04-3 (1) and 501-04-3 (2) hereof shall be approved by Underwriters Laboratories, Incorporated.

501-04-4 Service Stations which do NOT have room or stall for greasing, servicing, or storing motor vehicles, may be heated in any conventional manner.

501-04-5 All electric lighting appliances and wiring shall conform to the current National Electrical Code.

502 Storage and Handling

502-01 General Provisions: Class I and Class II flammable liquids shall be stored in closed containers, or in tanks located underground or in special enclosures as described in Section 502-02 of this division. Class III flammable liquids shall be stored in containers or in tanks located underground or in special enclosures as described in Section 502-02 of this division. Aboveground tanks, shall not be connected by piping to service station underground tanks.

502-02 Special Enclosures: When installation of tanks in accordance with section 210 of this division is impractical because of property or building limitations, tanks for flammable liquids may be installed in buildings if enclosed as follows: Enclosure shall be substantially liquid and vapor tight without backfill. Sides, top and bottom of the enclosure shall be of reinforced concrete at least 6 inches thick or approved solid-unit masonry equivalent-fire-resistive construction built to withstand the lateral pressure due to the liquid head, with openings for inspection through the top only. Tank connections shall be so piped or closed that neither vapors nor liquid can escape into the enclosed space. Means shall be provided whereby portable equipment may be employed to discharge to the outside any vapors which might accumulate should leakage occur.

502-03 Storage Inside Buildings: No Class I flammable liquids shall be stored or handled within any service station building except packaged items, for example: Cleaning fluid received and resold in unbroken metallic containers of not over one (1) gallon capacity each, or in approved non-metallic containers of not more than one (1) quart capacity each. Class II flammable liquids in closed containers may be stored inside the station building. A container equipped with an approved pump shall be considered a closed container for purposes of storage only. No Class I or Class II flammable liquids shall be dispensed, or transferred from one container to another, inside of a service station building, provided, however, that flammable anti-freeze liquids may be dispensed in rooms of a service station building provided such rooms have approved heating devices and provided also that there is no open flame in such room lower than 7 feet above floor level. Class III liquids may be stored and dispensed inside service station buildings from approved containers of not more than 120 gallons capacity each.

502-04 Except when sold in the original sealed container as put up for package sale or distribution by the manufacturer or packager with suitable and generally recognized precautionary labelling no gasoline or benzene nor any naptha having a flash point at or below 70°F. (closed cup tester) shall be sold or filled into any drum, can or other portable container unless the container is of metal and is colored red and labelled with the common name of the product and with the word "FLAMMABLE."

502-04-1 No kerosene, fuel oil or similar liquid shall be filled into any portable container colored red.

502-05 Dispensing Containers: No delivery of any Class I or II Flammable Liquids shall be made into portable containers of ten gallons capacity or less unless the container is of sound metal construction, has a tight closure with screwed or spring cover and is fitted with a spout or so designed that the contents can be poured without spilling or can be safely withdrawn by connection to a fuel line.

502-06 Bulk Sales Prohibited: No motor fuels shall be dispensed from storage at any service station except directly into the fuel tanks of motor vehicles, when such tanks are connected with the carburetion systems of such vehicles provided, however, that individual sales up to ten (10) gallons may be made in containers meeting the requirements of sections 502-04 and 502-05.

503 Dispensing Devices

503-01 Design and Construction: Class I and Class II flammable liquids shall be transferred from underground tanks by means of fixed pumps so designed and equipped as to allow control of the flow and to prevent leakage or accidental discharge. Supplemental means shall be provided outside of the dispensing device whereby the source of power may be readily disconnected in the event of fire or other accident. Dispensing devices for Class I or Class II flammable liquids shall be of approved type. Devices meeting the standards of the Underwriters' Laboratories, Inc., shall be deemed to be in compliance with this section. Class I or Class II flammable liquids shall not be dispensed by pressure or gravity from drums, barrels, and similar containers. Gear pumps or similar positive displacement devices taking suction through the top of the container shall be used. Class I and Class II flammable liquids shall not be dispensed by a device that exerts internal pressure against the shell or a storage tank, unless the tank has been approved as a pressure vessel for the use to which it is subjected. In no case shall air or gas pressure be used for this purpose.

503-02 Automatic Dispensing Devices: The installation and use of coin-purchaser-operated dispensing devices for Class I flammable liquids is prohibited. The dispensing of Class I flammable liquids into the fuel tank of a vehicle or into a container shall at all times be under the control of a competent person. The use of any device which permits the dispensing of Class I flammable liquids when the hand of the operator of the discharge nozzle is removed from the nozzle control lever is hereby forbidden except when using an automatic nozzle as provided in Section 503-02-1.

503-02-1 Automatic Nozzles With Latch-Open Devices: In lieu of being held open by hand, an approved automatic nozzle may be used for dispensing Class I flammable liquid into the fuel tank of a vehicle. Such a nozzle shall have the latch-open device as an integral part of the assembly and shall shut off the liquid reliably and positively when the gasoline tank is filled, when it falls from the filling neck of an automobile tank, when it is subject to rough usage such as dropping or lack of proper lubrication, or when an automobile is driven away while the nozzle is still in the tank. A competent attendant shall be in the immediate vicinity of the vehicle being filled by such an approved nozzle.

503-02-2 No Self-Service Permitted: No person other than the service station proprietor or an authorized employee shall use or operate any motor fuel dispensing equipment at any service station.

503-03 Location: Dispensing devices at automotive service stations shall be so located that all parts of the vehicle being served will be on private property.

503-04 Inside Garages: Where an outside location is impractical, dispensing devices for inside use may be approved for installation inside garage or similar establishment storing, parking, servicing or repairing automotive equipment. The dispensing device shall be located in an area of fire-resistive construction well away from vehicle storage and repair areas and well ventilated, preferably near a doorway. It shall be protected against physical damage by vehicles by mounting on a concrete island or by equivalent means and shall be located in a position where it cannot be struck by a vehicle descending a ramp or other slope out of control. A convenient remote emergency shut-off for electric power to the dispensing unit and the pump supplying it shall be provided.

504 Remote Pumping Systems

504-01 Scope: This subsection (d) shall apply to systems for dispensing Class I flammable liquid to the fuel tanks of motor vehicles at automotive service stations where such liquid is transferred from underground storage to individual or multiple dispensing units by pumps located elsewhere than at the dispensers.

504-02 Pumps: Pumps shall be designed or equipped so that no part of the system will be subjected to pressures above the system's allowable working pressure. Pumps installed above grade, outside of buildings, shall be located not less than ten feet from lines of adjoining property which may be built upon, and not less than five feet from any building opening. When an outside location is impractical, pumps may be installed inside of garages as provided for dispensers in subsection (c), paragraph 5, or they may be installed in special enclosures as described in section 43-10 except that approved fire doors are permitted, or in pits as described in paragraph 3 of this subsection. Pumps shall be substantially anchored and protected against physical damage by vehicles.

504-03 Pits: Pits for subsurface pumps or piping manifolds of submersible pumps shall withstand the external forces to which they may be subjected without damage to the pump, tank, or piping. The pit shall be no larger than necessary for inspection and maintenance and shall be provided with a close fitting cover.

504-04 Testing: After the completion of the installation including any paving, the section of the system, between the pump discharge and the connection for the dispensing facility, shall be tested for at least thirty minutes at a pressure fifty percent above the maximum pump pressure. Five years after installation and biannually thereafter, the system shall be subjected to a test for leakage of at least thirty minutes duration at the maximum pump pressure.

504-05 Controls:

504-05-1 A control shall be provided that will permit the pump to operate only when a dispensing nozzle is removed from its bracket on the dispensing unit and the switch on this dispensing unit is manually actuated. This control shall also stop the pump when all nozzles have been returned to their brackets.

504-05-2 There shall be a means, visible from the operating area, to indicate when the pump motor is running.

504-05-3 A readily accessible, clearly identified switch shall be provided to shut off the power to the pump motors. An approved automatic device shall be provided at each dispensing unit that will stop the flow of fuel at the dispensing unit in case of fire or physical damage to the dispensing unit.

505 Marine Service Station

505-01 Pumps supplying flammable liquids at marine service stations shall be located on shore, or on a pier of solid-fill type, where practicable.

505-02 Class I or II flammable liquids shall not be dispensed into fuel tanks of marine craft except by means of a hose, equipped with a self-closing nozzle and with a valve which must be held open by manual control while making a delivery.

505-03 Pipe lines at marine service stations, where attached to piers, wharves, or other structures, shall be protected against physical damage. A valve shall be provided in each line at or near the approach to the pier, wharf, or other structure whereby supply from shore may be shut off.

505-04 Flammable liquids may be dispensed into the fuel tanks of marine craft from tank trucks by means of a hose equipped with a self-closing nozzle and in the case of Class I or II liquids with a valve which must be held open by manual control while making a delivery or from approved safety cans.

506 Drainage and Waste Disposal

Provision shall be made in the area where Class I flammable liquids may be spilled to prevent liquids from flowing into interior of service-station buildings. Such provision may be by grading driveway, raising door sills, or other equally effective means. Crankcase drainings and flammable liquids shall not be dumped into sewers, but shall be stored in tanks or tight drums outside of any building until removed from the premises.

507 Safety Rules

There shall be no smoking on the driveway of service stations in the areas used for fueling motor vehicles, dispensing flammable anti-freeze or the receipt of products by tank truck, or in those portions of the buildings used for servicing automobiles, tractors or internal combustion engines. The motors of all vehicles being fueled shall be shut off during the fueling operation.

507-01 No open lights or flames shall be permitted about premises except in approved heating devices and for necessary maintenance.

507-02 Premises shall be kept neat and clean, and free from rubbish or trash.

507-03 Cleaning with gasoline, naptha, or other highly flammable liquids of Classes I and II shall not be permitted in or around the service station.

508 First-aid Fire Appliances

Suitable first-aid fire-control devices, such as small hose or portable extinguishers, shall be available to locations where fires are likely to occur.

CHAPTER VI

Commercial and Industrial Establishments

601 Manner of Storage

601-01 Flammable liquids shall be stored in tanks, closed containers or approved safety cans.

601-02 Flammable liquids stored in tanks shall conform to the applicable requirements of Part One or Part Two of Chapter II.

601-03 Flammable liquids stored in drums and other closed containers shall conform to the applicable requirements of Part Three or Part Four of Chapter II.

601-04 Flammable liquids used, mixed or handled in tanks, drums or other containers shall conform to the applicable requirements of section 602.

602 Use of Flammable Liquids

602-01 Location: Flammable liquids in quantities requiring a permit shall be used in buildings, portions of buildings or rooms constructed and designed in accordance with the requirements of Inside Mixing and Handling Rooms.

602-02 Design and Construction of Inside Mixing and Handling Rooms: Rooms shall have at least one exterior wall. Walls, floors and ceilings shall be of noncombustible construction having at least a two hour fire-resistive rating. Doors shall be provided with noncombustible liquid-tight sills at least six inches high and provided with an approved Class B fire door of the self-closing type. Adequate drainage to a safe location shall be provided. Adequate natural ventilation shall be provided or if mechanical ventilation is provided, compliance with appropriate requirements of the NFPA Standards on Blower and Exhaust Systems for Dust, Stock and Vapor Removal, No. 91 shall be deemed prima facie evidence of compliance with this section. Heating shall be by low pressure steam or hot water or by electrical units approved for Class I hazardous locations. Lighting and electrical devices shall be approved for Class I hazardous locations. All equipment such as mixers, filters, pumps, motors, shafting shall be permanently and effectively grounded. Electrical installations made in accordance with the then current edition of National Electrical Code shall be deemed prima facie evidence of compliance with this section.

602-03 Storage Limits for Inside Mixing and Handling Rooms: An Inside Mixing and Handling Room not protected by an approved automatic fire extinguisher system shall contain not more than

(1) 1,100 gallons total of Class I, II and III flammable liquids of which not more than,

(2) 550 gallons may be of Class I and II flammable liquids of which not more than,

(3) 275 gallons may be of Class I flammable liquid.

An Inside Mixing and Handling Room protected by an approved automatic fire extinguishing system shall not contain more than

(1) 11,000 gallons total of Class I, II and III flammable liquids of which not more than,

(2) 2,750 gallons may be of Class I and II flammable liquids of which not more than,

(3) 550 gallons may be of Class I flammable liquid.

(4) These amounts may be increased to not more than one day's supply where daily consumption exceeds the above limits.

602-04 Where applicable, installations made in accordance with the then current edition of NFPA Standards for Dry Cleaning Plants, No. 32; for Dip Tanks Containing Flammable or Combustible Liquids, No. 34; and Spray Finishing Using Flammable Materials, No. 33 shall be deemed prima facie evidence of compliance with this section.

603 Dispensing

603-01 Class I or Class II flammable liquids shall be dispensed only in an Inside Mixing and Handling Room.

603-02 Class I or Class II flammable liquids shall not be drawn from or dispensed into vessels or containers within a building except by means of a device drawing from top of the tank or the container. Gravity discharge within a building of Class I or Class II flammable liquids from tanks, drums, or containers other than safety cans, is specifically forbidden, except where the nature of the manufacturing process requires gravity flow. Upon approval of the State Fire Marshal, such gravity flow shall be permitted only from vessels storing flammable liquids sufficient for not more than one day's operation.

603-03 Class I or Class II flammable liquids shall not be dispensed within a room or building which normally contains source of ignition, within the possible path of vapor travel. Dispensing devices shall be provided with iron or steel valves where compatible with the flammable liquid handled. Where practicable, there shall be, in addition to the outlet valve, a secondary control device or valve outside of the immediate area, by which the flow may be stopped in the event of fire or other accident at the outlet. Outlet valves, where practicable, shall be of the self-closing type.

603-04 Container Filling Facilities: Class I and II flammable liquids shall not be run into containers unless the nozzle and container are electrically interconnected. Where the metallic floor plate on which the container stands while filling is electrically connected to the fill stem or where the fill stem is bonded to the container during filling operations by means of a bond-wire, the provisions of this section shall be deemed to have been complied with.

603-05 Exits: Exit facilities shall be provided to prevent occupants being trapped in the event of fire.

604 Ventilation

604-01 Buildings, or rooms or other enclosures in which Class I or Class II flammable liquids are used or stored in open vats or dip tanks shall be provided with ventilation sufficient at all times to prevent accumulation of flammable

vapors. Where natural ventilation is insufficient under all conditions to prevent the accumulation of flammable vapors, mechanical ventilation shall be provided and used. The accumulation of flammable vapors within the combustible or explosive range under normal operating conditions, as determined by an approved flammable-vapor indicator, shall be prima facie evidence of the violation of this section.

604-02 Design of ventilating systems shall take into account the relatively high specific gravity of the vapors. Opening to the outside for natural ventilation shall be at floor level and shall be unobstructed except by louvers, or coarse screens. Mechanical systems for removing flammable vapors, designed, installed and operated in accordance with the then current edition of National Fire Protection Association Standards for the Installation of Blower and Exhaust Systems shall be deemed prima facie evidence of compliance with this section.

605 Sources of Ignition

Open flames, heating devices and processes employing temperatures capable of igniting the vapors of the flammable liquids used shall be prohibited in buildings, rooms and other confined places in which Class I or Class II flammable liquids are used in the open, or in which Class III flammable liquids are used for the purpose of saturating, coating or otherwise treating goods or materials. Artificial lighting shall be by electricity only. Electric devices located within the possible path of vapor travel shall be of a type approved for such locations. Compliance with applicable provisions of the "National Electrical Code" as published by the National Fire Protection Association shall be deemed prima facie evidence of compliance with this section. Smoking shall be prohibited and suitable signs to that effect shall be displayed.

606 Fire Control

606-01 Inside Mixing and Handling Rooms may be sprinklered or unsprinklered. Where flammable liquids are used or dispensed, approved first aid fire appliances shall be provided. The number and type of appliances meeting the current standard for First Aid Fire Appliances, NFPA No. 10 shall be deemed prima facie evidence of compliance with this section.

606-02 Wherever flammable liquids are stored in containers, provisions shall be made and maintained for the detection of leakage. Leaking containers shall be immediately removed or made tight.

606-03 Access shall be provided by unobstructed aisles whereby first-aid fire-control apparatus may be brought to bear on any part of such flammable liquids storage.

606-04 In buildings, rooms or other confined spaces in which flammable liquids are stored, combustible waste materials shall not be allowed to accumulate, except in closed metal containers.

606-05 Crankcase drainings and flammable liquids shall not be dumped into sewers, but shall be stored in tanks or tight drums outside of any building until removed from the premises.

606-06 Cleaning with gasoline, naptha, or other highly flammable liquids of Class I and II shall not be permitted.

CHAPTER VII

Processing Plants

701 Manner of Storage

701-01 Flammable liquids shall be stored in tanks, closed containers or approved safety cans.

701-02 Flammable liquids stored in tanks shall conform to the applicable requirements of Part One or Part Two of Chapter II or Section 502-02.

701-03 Flammable liquids stored in drums or other closed containers shall conform to the requirements of Part Three or Part Four of Chapter II or Paragraph 701-04.

701-04 Storage of flammable liquids within rooms or buildings not meeting the requirements of Chapter II shall be limited in accordance with the following subsections:

701-04-1 Within wood frame buildings, storage of Class I and Class II flammable liquids shall be prohibited; storage of Class III flammable liquids shall be limited to 60 gallons in any tank or container unless installed and constructed in accordance with Chapter II of this Division.

701-04-2 In other than wood frame buildings, Class I flammable liquids may be stored in closed containers or safety cans of not more than five gallons individual capacity and not exceeding a total of 25 gallons. Class II flammable liquids may be stored in closed containers or safety cans of not more than five gallons individual capacity, and in barrels, drums, or tanks of not more than 60 gallons individual capacity. The total quantity that may be stored in this manner shall be limited to 220 gallons. Class III flammable liquids may be stored in closed containers of not more than five gallons individual capacity, or in barrels, drums, or tanks not exceeding 120 gallons individual capacity. The total quantity stored in this manner shall be limited to 220 gallons.

702 Blending and Mixing

702-01 Mixing or blending rooms or buildings shall meet the design standards of Section 602-02 of this chapter. Mixing or blending rooms or buildings shall be provided with natural or mechanical ventilation that will prevent the accumulation of flammable vapors in hazardous concentrations. Design of ventilating systems shall take into account the relatively high specific gravity of the vapors. Openings in outside walls for natural ventilation shall be at floor level and shall be unobstructed except by louvers, or coarse screens. Mechanical systems for removing flammable vapors, designed, installed and operated in accordance with the then current edition of National Fire Protection Association Standards for the "Installation of Blower and Exhaust Systems" shall be deemed prima facie evidence of compliance with this section.

702-02 Vessels used for mixing or blending of Class I flammable liquids shall be provided with self-closing tight-fitting noncombustible lids that will control a fire within such vessel when applied thereto. Where such devices are impracticable, approved automatic or manually controlled chemical or other fire-extinguishing devices shall be used.

702-03 Open flames and other sources of ignition shall not be used within the possible path of vapor travel where flammable liquids are mixed or blended in open containers.

702-04 Vessels shall be electrically connected by bond-wires, piping, or similar means, where differences of potential could otherwise be created by accumulation of static-electrical charges.

703 Dispensing From Containers Within Buildings

703-01 Class I or Class II flammable liquids may be dispensed from approved safety cans, provided that there are no open flames or other sources of ignition within the possible path of vapor travel.

703-02 Class III flammable liquids may be dispensed from containers not exceeding 60 gallons in individual capacity by means of a pump or similar device taking suction through the top of the container.

704 Sources of Ignition

Open flames, heating devices and processes employing temperatures capable of igniting the vapors of the flammable liquid used shall be prohibited in buildings, rooms and other confined spaces in which Class I or Class II flammable liquids are used in the open, or in which Class III flammable liquids are heated above their flash point in open containers. Artificial lighting shall be by electricity only. Electrical devices located within the possible path of vapor travel shall be of a type approved for such locations. Electrical devices meeting the applicable standards of the current edition of the "National Electrical Code" as published by the National Fire Protection Association, shall be deemed prima facie evidence of compliance with this section.

705 Housekeeping

705-01 Wherever flammable liquids are stored in containers, provision shall be made and maintained for the detection of leakage. Leaking containers shall be immediately removed and the contents transferred to a tight container.

705-02 Access shall be provided by unobstructed aisles whereby first-aid fire-control apparatus may be brought to bear on any part of such flammable liquids storage.

705-03 In buildings, rooms or other confined spaces in which flammable liquids are stored, combustible waste materials shall not be allowed to accumulate, except in closed metal containers.

705-04 Crankcase drainings and flammable liquids shall not be dumped into sewers, but shall be stored in tanks or tight drums outside of any building until removed from the premises.

705-05 Cleaning with gasoline, naptha, or other highly flammable liquids of Classes I and II shall not be permitted.

706 First-aid Fire Control

Where flammable liquids are stored, or are used in open vessels, or are dispensed within buildings or other enclosures, first-aid fire-control equipment shall be provided in such quantities as public safety shall require. The number and type of appliance meeting the Standards for First Aid Fire Appliances as published by the National Fire Protection Association shall be deemed prima facie evidence of compliance with this section.

CHAPTER VIII

Oil Burning Equipment

801 Oil Burners

Heating and other devices using oil burners shall be installed, maintained and operated in accordance with recognized safe practices. Burners and accessories such as piping, tanks, vents, control devices, etc., installed in compliance with the then current edition of National Fire Protection Association Standards for the Installation of Oil Burning Equipment (NFPA No. 31), shall be deemed prima facie evidence of compliance with the installation requirements of this section.

802 Fuel Oil

The grade of fuel oil used in a burner shall be that for which the burner is listed and as stipulated by the manufacturer. Crankcase oil or any oil containing gasoline shall not be used.

CHAPTER IX

Farm Storage of Flammable Liquids

901 Scope

The Standards are intended to apply to flammable liquids used for fuel for internal combustion engines and for agricultural processes such as spraying, flame cultivation, etc. It does not apply to the storage of fuel oil for heating purposes, which is covered by Chapter VIII of this division.

902 Types of Approved Storage

Storage of flammable liquids in rural districts for private use shall be permitted in any of the following ways:

(a) Underground storage as provided in Part Two of Chapter II of this division.

(b) Aboveground storage in tanks the capacity of which exceeds 500 gallons as provided in Part One of Chapter II of this division and located at least 40 feet from any building.

(c) Containers of 60 gallons or less capacity each, in accordance with applicable standards set forth in this chapter.

(d) Containers of 60 to 550 gallons capacity each, in accordance with applicable standards set forth in this chapter.

903 Individual Containers of 60 Gallons or Less Capacity Each

Flammable liquids in containers of 60 gallons or less capacity shall be stored outside buildings in substantial closed metal drums of 60 gallons or less capacity each. Discharge devices requiring pressure on the container are prohibited. Pumping devices or faucets used for dispensing flammable liquids shall be well maintained to prevent leakage. Individual containers shall not be interconnected.

Containers as provided in this section shall be stored outside at least 40 feet from any building or may be stored inside of a building used exclusively for the storage of flammable liquids and located at least 40 feet from any other building. Buildings used for storage of flammable liquids shall be provided with cross ventilation with at least two vents of 64 square inches area each, placed at floor level.

904 Containers of 60 to 550 Gallons Capacity Each

904-01 Flammable liquids in aboveground containers of 60 to 550 gallons capacity shall be stored outside buildings in containers of single compartment design and constructed throughout of 14 gauge metal or heavier and made vapor tight by welding or equivalent construction.

904-02 A fill opening shall be provided and shall be equipped with a closure designed so that it may be locked.

904-03 A vent shall be provided to relieve such vacuum or pressure as will develop in normal operation or form exposure to fire. Such vent shall have a free opening of 1½ in. diameter.

904-04 Containers as provided in this section shall be kept outside and at least 40 feet from any building and shall be so located or such additional distance to buildings shall be provided as will insure that no vehicle, equipment or vessel being filled directly from such container shall be closer than 40 feet to any building.

904-05 Containers as above may be of either of the following types:

904-05-1 Containers With Top Openings Only.

Containers constructed and located as provided above may be designed with all openings in the top of the tank and in such event shall be mounted and equipped as follows:

Stationary containers shall be mounted on timbers or blocks approximately 6 inches in height so as to protect the bottom of the container from corrosion from contact with the ground and when so placed to be in a stable position; or portable containers may be equipped with attached metal legs resting on shoes or runners to be at least one tank diameter apart, which in turn rests upon the ground, designed so that the container is supported in a stable position and so that the entire container and its supports may be moved as a unit.

Containers shall be equipped with a tightly and permanently attached approved pumping device having an approved hose of sufficient length for filling vehicles, equipment or vessels to be served from the container. Either the pump or the hose shall be equipped with a padlock to its hanger to prevent tampering. An effective anti-siphoning device shall be included in the pump discharge. Siphons or internal pressure discharge devices are prohibited.

904-05-2 Containers Elevated For Gravity Discharge.

Containers constructed and located as above may be designed with an opening in the bottom or the end of the tank for gravity dispensing of flammable liquids and shall be mounted and equipped as follows:

Supports to elevate the tank for gravity discharge shall be of adequate strength and design to provide stability.

On containers installed after the effective date of these regulations, each bottom opening for gravity discharge shall be equipped with an internal safety valve, which will close automatically in the event of fire through the operation of an effective heat releasing device and which likewise may be quickly operated manually. The gravity discharge outlet shall be provided with an approved hose equipped with a self-closing valve at the discharge end, of a type that can be padlocked to its hanger to prevent tampering.

905 Marking of Containers

Containers for the storage of flammable liquids in rural districts shall be conspicuously marked with the name of the product which they contain and "FLAMMABLE—KEEP FIRE AND FLAME AWAY." If any such containers are portable and are used for the storage of Class I or Class II flammable liquids, they shall be painted red and labeled with the common name of the product and with the word "FLAMMABLE." No kerosene, fuel oil or similar liquid shall be placed in a red container.

DIVISION III

Transportation and Delivery of Flammable Liquids by Tank Vehicles

110 Scope

This regulation applies to tank motor vehicles to be used for the transportation or delivery of flammable liquids. It is intended to provide requirements for the design, construction and operation of tank motor vehicles, their appurtenances, and certain features of tank motor vehicle chassis.

Additional safeguards may be necessary for tank vehicles used for the transportation of flammable liquids having characteristics introducing additional factors such as high rates of expansion, corrosiveness and toxicity.

Nothing in this regulation shall be construed to prevent any shipment made in accordance with the Interstate Commerce Commission regulations.

120 Definitions

121 Tank Truck. Any single self-propelled motor vehicle equipped with a cargo tank mounted thereon, and used for the transportation of flammable liquids.

122 Tank Full Trailer. Any vehicle with or without auxiliary motive power, equipped with a cargo tank mounted thereon or built as an integral part thereof, and used for the transportation of flammable liquids, and so constructed that, practically all of its weight and load rests on its own wheels. (Note: Not permitted under Iowa Law)

123 Tank Semi-Trailer. Any vehicle with or without auxiliary motive power, equipped with a cargo tank mounted thereon or built as an integral part

thereof, and used for the transportation of flammable liquids, and so constructed that, when drawn by a tractor by means of a fifth wheel connection, some part of its load and weight rests upon the towing vehicle.

124 Tank Vehicle. Any tank truck, tank full trailer, or tractor and tank semi-trailer combination.

125 Cargo Tank. Any container having a liquid capacity in excess of 100 gallons, used for the carrying of flammable liquids, and mounted permanently or otherwise upon a tank vehicle. The term "cargo tank" does not apply to any container used solely for the purpose of supplying fuel for the propulsion of the tank vehicle upon which it is mounted.

126 Baffle. A non-liquid-tight transverse partition in a cargo tank.

127 Compartment. A liquid-tight division in a cargo tank.

128 Head and Bulkhead. A liquid-tight transverse closure at the end of a cargo tank or between compartments of a cargo tank.

200 Cargo Tanks, Piping and Connections

210 Cargo Tanks Constructed of Mild Steel

211 Material. All sheets for such cargo tanks shall be of mild steel to meet the following requirements:

Yield Point, minimum .....25,000 pounds per sq. in.
Ultimate Strength, minimum .....45,000 pounds per sq. in.
Minimum Elongation, standard 2-inch sample .....20 per cent

212 Thickness of Sheets. The minimum thickness of tank sheets shall be limited by the volume capacity of the tank expressed in terms of gallons per inch of length; and by the distance between bulkheads, baffles, or other shell stiffeners, as well as by the radius of shell curvature in case of shell sheets; as follows:

Minimum Thickness of Head, Bulkhead and Baffle Sheets*
Mild Steel

Heads, Bulkheads, or Baffles	(Dished, Corrugated, Reinforced or Rolled)			
Volume Capacity of Tank in Gallons per Inch of Length	10 or Less	Over 10 to 14	Over 14 to 18	Over 18
Manufacturers Gauge No.	14	13	12	11

Minimum Thickness of Shell Sheets
Mild Steel

Volume Capacity of Tank in Gallons Per Inch of Length	Distance Between Attachments of Bulkheads, Baffles or Other Shell Stiffeners: 36 Inches or less		Over 36 inches to 54 inches		Over 54 inches	
Maximum Shell Radius of less than 70 inches:	Gauge** No.	Approx. Thick. Decimals of in.	Gauge** No.	Approx. Thick. Decimals of in.	Gauge** No.	Approx. Thick. Decimals of in.
10 Gallons or less	14	0.0747	14	0.0747	14	0.0747
Over 10 to 14 gallons	14	0.0747	14	0.0747	13	0.0897
Over 14 to 18 gallons	14	0.0747	13	0.0897	12	0.1046
Over 18 gallons	13	0.0897	12	0.1046	11	0.1196
Maximum Shell Radius of 70 inches or more, but less than 90 inches:						
10 gallons or less	14	0.0747	14	0.0747	13	0.0897
Over 10 to 14 gallons	14	0.0747	13	0.0897	12	0.1046
Over 14 to 18 gallons	13	0.0897	12	0.1046	11	0.1196
Over 18 gallons	12	0.1046	11	0.1196	10	0.1345
Maximum Shell Radius of 90 inches or more, but less than 125 inches:						
10 gallons or less	14	0.0747	13	0.0897	12	0.1046
Over 10 to 14 gallons	13	0.0897	12	0.1046	11	0.1196
Over 14 to 18 gallons	12	0.1046	11	0.1196	10	0.1345
Over 18 gallons	11	0.1196	10	0.1345	9	0.1495
Maximum Shell Radius of 125 inches or more:						
10 gallons or less	13	0.0897	12	0.1046	11	0.1196
Over 10 to 14 gallons	12	0.1046	11	0.1196	10	0.1345
Over 14 to 18 gallons	11	0.1196	10	0.1345	9	0.1495
Over 18 gallons	10	0.1345	9	0.1495	8	0.1685

*Thickness of exterior head sheets shall never be less than the maximum requirements for shell sheets in any specific unit.
**Manufacturers Standard Gauge and approximate equivalent thickness in decimals of inch.

220 Cargo Tanks Constructed of Low Alloy Low Carbon (High Tensile) Steel

221 Material. All sheets for such cargo tanks shall be of low alloy, low carbon steel, commonly known as high tensile, meeting the following requirements:

Yield Point, minimum .....50,000 pounds per square in.
Ultimate Strength, minimum .....65,000 pounds per square in.
Minimum Elongation, standard 2-inch sample .....20 per cent

222 Thickness of Sheets. The minimum thickness of tank sheets shall be limited by the volume capacity of the tank, expressed in terms of gallons per inch of length; and by the distance between bulkheads, baffles, or other shell stiffeners, as well as by the radius of shell curvature in the case of shell sheets; as follows:

Low Alloy Low Carbon (High Tensile) Steel

Minimum Thickness of Head, Bulkhead and Baffle Sheets*

Heads, Bulkheads, or Baffles	(Dished, Corrugated, Reinforced or Rolled)			
Volume Capacity of Tank in Gallons per Inch of Length	10 or Less	Over 10 to 14	Over 14 to 18	Over 18
Manufacturers Gauge No.	15	14	13	12

*Thickness of exterior head sheets shall never be less than the maximum requirements for shell sheets in any specific unit.

Minimum Thickness of Shell Sheets

Low Alloy Low Carbon (High Tensile) Steel

	Distance Between Attachments of Bulkheads, Baffles or Other Shell Stiffeners					
	36 inches or less		Over 36 inches to 54 inches		Over 54 inches	
Maximum Shell Radius of less than 70 inches:	Gauge* No.	Approx. Thick. Decimals of in.	Gauge* No.	Approx. Thick. Decimals of in.	Gauge* No.	Approx. Thick. Decimals of in.
10 gallons or less	16	0.0588	16	0.0588	15	0.0673
Over 10 to 14 gallons	16	0.0588	15	0.0673	14	0.0747
Over 14 to 18 gallons	15	0.0673	14	0.0747	13	0.0897
Over 18 gallons	14	0.0747	13	0.0897	12	0.1046
Maximum Shell Radius of 70 inches or more, but less than 90 inches:						
10 gallons or less	16	0.0588	15	0.0673	14	0.0747
Over 10 to 14 gallons	15	0.0673	14	0.0747	13	0.0897
Over 14 to 18 gallons	14	0.0747	13	0.0897	12	0.1046
Over 18 gallons	13	0.0897	12	0.1046	11	0.1196
Maximum Shell Radius of 90 inches or more, but less than 125 inches:						
10 gallons or less	15	0.0673	14	0.0747	13	0.0897
Over 10 to 14 gallons	14	0.0747	13	0.0897	12	0.1046
Over 14 to 18 gallons	13	0.0897	12	0.1046	11	0.1196
Over 18 gallons	12	0.1046	11	0.1196	10	0.1345
Maximum Shell Radius of 125 inches or more:						
10 gallons or less	14	0.0747	13	0.0897	12	0.1046
Over 10 to 14 gallons	13	0.0897	12	0.1046	11	0.1196
Over 14 to 18 gallons	12	0.1046	11	0.1196	10	0.1345
Over 18 gallons	11	0.1196	10	0.1345	9	0.1495

*Manufacturers Standard Gauge and approximate equivalent thickness in decimals of inch.

230 Cargo Tanks Constructed of Aluminum Alloys for High Strength Welded Construction

231 Material. All sheets for shell, heads and bulkheads of such cargo tanks shall be of aluminum alloys GR20A (5052 commercial designation), GR40A (5154 commercial designation) or GM40A (5086 commercial designation), conforming to American Society for Testing Materials Specification B178-54T.

All heads, bulkheads, baffles and other shell stiffeners may use 0 temper (annealed) or stronger tempers. All shell shall be of H32 temper or H34 temper, except that when shell thicknesses of 0.250 inch or thicker are used, the H112 temper is additionally permitted.

232 Thickness of Sheets. The minimum nominal thickness of tank sheets shall be limited by the volume capacity of the tank, expressed in terms of gallons per inch of length; and by the distance between bulkheads, baffles, or other shell stiffeners, as well as by the radius of shell curvature in the case of shell sheets as follows:

Minimum Thickness of Head, Bulkhead and Baffle Sheets*

Aluminum Alloys GR20A, GR40A, and GM40A

Heads, Bulkheads or Baffles	(Dished, Corrugated, Reinforced or Rolled)			
Volume Capacity of Tank in Gallons per Inch of Length	10 or Less	Over 10 to 14	Over 14 to 18	Over 18
Thickness in decimals of inches	.096	.109	.130	.151

*Thickness of exterior head sheets shall never be less than the maximum requirements for shell sheets.

Minimum Thickness of Shell Sheets

Aluminum Alloys GR20A, GR40A and GM40A

Volume Capacity of Tank in Gallons Per Inch Of Length	Distance Between Attachments of Bulkheads, Baffles or Other Shell Stiffeners		
	36 inches or less	Over 36 inches to 54 inches	Over 54 inches
Inch Decimal Thickness for Maximum Shell Radius of Less than 70 inches:			
10 gallons or less	.087	.087	.096
Over 10 to 14 gallons	.087	.096	.109
Over 14 to 18 gallons	.096	.109	.130
Over 18 gallons	.109	.130	.151
Inch Decimal Thickness for Maximum Shell Radius of 70 inches or more, but less than 90 inches:			
10 gallons or less	.087	.096	.109
Over 10 to 14 gallons	.096	.109	.130
Over 14 to 18 gallons	.109	.130	.151
Over 18 gallons	.130	.151	.173
Inch Decimal Thickness for Maximum Shell Radius of 90 inches or more, but less than 125 inches:			
10 gallons or less	.096	.109	.130
Over 10 to 14 gallons	.109	.130	.151
Over 14 to 18 gallons	.130	.151	.173
Over 18 gallons	.151	.173	.194
Inch Decimal Thickness for Maximum Shell Radius of 125 inches or more,			
10 gallons or less	.109	.130	.151
Over 10 to 14 gallons	.130	.151	.173
Over 14 to 18 gallons	.151	.173	.194
Over 18 gallons	.173	.194	.216

240 Joints

241 Joints shall be made in accordance with recognized good practice and the efficiency of any joint shall be not less than 85 per cent of that of the adjacent metal in the tank. Low alloy low carbon (high tensile) steel sheets, however, shall be joined by fusion welding.

242 Mild steel and low alloy low carbon steel may be used in the construction of a single tank, provided each material, where used, shall comply with the minimum requirements of its respective specifications for that section of the tank.

243 In cargo tanks constructed of aluminum alloys, all joints in and to tank shells, heads and bulkheads shall be welded. All welded aluminum joints shall be made in accordance with recognized good practice, and the efficiency of a joint shall not be less than 85% of the annealed properties of the material in question. Aluminum alloys for high strength welded construction shall be joined by an inert gas arc welding process using filler metals R-GR40A, E-GR40A (5154 alloy) and R-GM50A, E-GM50A (5356 alloy) as conforming to American Society of Testing Materials Specification No. B285-54T (American Welding Society Specification No. A5, 10-54T).

250 Test

251 At the time of manufacture every cargo tank shall be tested by a minimum air or hydrostatic pressure of 3 pounds per square inch applied to each compartment, or to the whole tank if it be not divided into compartments. Such pressure shall be maintained for a period of at least 5 minutes, during which, if the test is by air pressure, the entire exterior surface of all the joints shall be coated with a solution of soap and water, heavy oil, or other material suitable for the purpose, foaming or bubbling of which will indicate the presence of leaks. Hydrostatic pressure, if used, shall be gauged at the top of the tank; and the tank shall be inspected at the joints for the issuance of liquid to indicate leaks. Any leakage discovered by either of the methods above described, or by any other method shall be deemed as evidence of failure to meet the requirements of this specification.

260 Tank Outlets

261 Outlets shall be substantially made and so attached to the tank.

270 Bulkheads and Baffles

271 Every cargo tank having a total capacity in excess of 3,000 gallons and used for the distribution of Class I and Class II flammable liquids to automotive and marine service stations to which the public is invited shall be divided into compartments, no one of which shall exceed 2,500 gallons. A designed tolerance of 10 per cent shall be allowed for capacities of individual compartments or tanks.

272 Except as provided in section 271, bulkheads or compartments shall not be required in any cargo tank used for transportation service, regardless of total capacity, which, when loaded and transporting its cargo over streets and highways will contain not less than 80 per cent of the total tank capacity and will discharge its entire contents at one unloading point. As to tank vehicles operating from, to, or within areas requiring seasonal reduction in size of cargo, the 80 per cent requirement shall be waived during the period in which such restrictions are in effect.

273 Every cargo tank, and every compartment over 90 inches in length, shall be provided with baffles, the number of which shall be such that the linear distance between any two adjacent baffles, or between any tank head or bulkhead and the baffles nearest it, shall in no case exceed 60 inches.

274 The cross sectional area of each baffle shall be not less than 80 per cent of the cross sectional area of the tank and the thickness of such baffle shall be not less than that required for heads and bulkheads of the cargo tank in which installed.

275 Cargo tanks with compartments carrying flammable liquids of different classes shall be provided with an air space between compartments and this air space shall be equipped and maintained with drainage facilities operative at all times.

280 Vents

281 Each cargo tank or compartment shall be provided with a vacuum and pressure operated vent with a minimum effective opening of 0.44 square inch, and shall also be provided with an emergency venting facility so constructed as to provide a minimum free-venting opening having a net area in square inches equal to 1.25 plus 0.0025 times the capacity of the cargo tank or compartment in gallons. If the emergency venting facility operates in response to elevated temperatures, the critical temperature for such operation shall not exceed 200°F.

290 Valve and Faucet Connections

291 Draw-off valves and faucets shall have discharge ends threaded, or they shall be designed so as to permit being tightly connected to hose extending to fill pipe.

300 Emergency-Discharge Control

301 Every outlet from any cargo tank any compartment of which has a capacity in excess of 500 gallons, if used for transportation of Class I or II flammable liquids, shall be equipped with a reliable and efficient shut-off valve located inside the shell; or in the sump when it is an integral part of the shell; and designed so that the valve must be kept closed except during loading and unloading operations.

302 The operating mechanism for the valve shall be provided with a secondary control, remote from the fill openings and discharge faucets, for use in the event of accidents or fire during delivery operations.

303 The control mechanism shall be provided with a fusible section which will permit valves to close automatically in case of fire.

304 In every case there shall be provided, between the shut-off valve seat and discharge faucet, a shear section which will break under strain unless the discharge piping is so arranged as to afford the same protection and leave the shut-off valve seat intact.

400 Tank-Vehicle Chassis, Assembly and Appurtenances

410 Tires

411 All tank motor vehicles shall be equipped with rubber tires on all wheels.

420 Assembly

421 Every cargo tank shall be adequately supported upon and securely attached to or be a part of the tank vehicle upon which it is carried.

430 Static Protection

431 Cargo tanks, and vehicle chassis, shall be electrically bonded.

432 Provision shall be made in the tank structure of the vehicle for the bonding of vehicle to the fill pipe during truck loading operations.

433 All hoses used on transports (4,000 gallon capacity or larger) for unloading Class I or II liquids shall be wire-filled.

434 Drag chains and straps, formerly specified for the purpose of eliminating static charges, have been shown to be ineffective and their elimination is recommended.

440 Protection Against Collision

441 Draw-off valves or faucets projecting beyond the frame at the rear of a tank vehicle shall be adequately protected against collision by bumpers or similar means.

450 Lighting

451 No lighting device other than electric lights shall be used on tank vehicles. Lighting circuits shall have suitable over-current protection (fuses or automatic circuit breakers). The wiring shall have sufficient carrying capacity and mechanical strength, and shall be secured, insulated, and protected against physical damage, in keeping with recognized good practice.

460 Fuel System

461 Fuel tanks shall be so designed, constructed and installed as to present no unusual hazard, and shall be so arranged as to vent during filling operations and permit drainage without removal from their mountings.

462 All portions of the fuel-feed system, including carburetor, pumps, and all auxiliary mechanisms and connections shall be constructed and installed in a workmanlike manner, and so constructed and located as to minimize the fire hazard with no readily combustible materials used therein, and shall, except for Diesel fuel connections, be well separated from the engine exhaust system. A pressure-release device shall be provided where necessary. The fuel-feed lines shall be made of materials not adversely affected by the fuel to be used or by other materials likely to be encountered, of adequate strength for their purpose, well secured to avoid chafing, or undue vibration, having a readily accessible and reliable shut-off valve or stop-cock. Joints depending upon solder for mechanical strength and liquid tightness shall not be used in the fuel system at or near the engine, or its accessories, unless the solder has a melting point of not less than 340°F., or unless a self-closing, thermally controlled valve set to operate at not exceeding 300°F., or other equivalent automatic device, shall be installed in the fuel line on the fuel-tank side of such joint.

470 Exhaust System

471 The exhaust system, including muffler (or silencer) and exhaust line shall have ample clearance from the fuel system and combustible materials, and shall not be exposed to leakage or spillage of product or accumulations of grease, oil or gasoline.

472 The exhaust system, including all units, shall be constructed and installed in a workmanlike manner. A muffler (or silencer) cut-out shall not be used.

480 Semi-Trailers

481 Semi-trailers shall be firmly and securely attached to the vehicle drawing them, in a manner conforming with recognized good practice.

482 Each semi-trailer shall be equipped with reliable brakes on all wheels, and adequate provision shall be made for their efficient operation from the drivers' seat of the vehicle drawing the trailer, or semi-trailer.

483 Trailer connections shall be such as to prevent the towed vehicle from whipping or swerving from side to side dangerously or unreasonably and shall cause the trailer to follow substantially in the path of the towing vehicle.

490 Fire Extinguishers

491 Each tank vehicle shall be provided with at least one portable fire extinguisher having at least a 12-B, C rating or when more than one is provided, each extinguisher shall have at least a 6-B rating. Ratings shall be in accordance with the standards of the National Fire Protection Association pamphlet No. 10. Fire extinguishers shall be kept in good operating condition at all times, and they shall be located in an accessible place on each tank vehicle.

500 Auxiliary Internal Combustion Engines

501 Internal combustion engines, other than those providing propulsive

power, installed or carried upon a tank vehicle, transporting Class I and II flammable liquids for the purpose of providing power for the operation of pumps or other devices, shall meet the following requirements:

502 The engine air intake shall be equipped with an effective flame arrester, or an air cleaner having effective flame arrester characteristics, substantially installed and capable of preventing emission of flame from the intake side of the engine in event of backfiring.

503 The fuel system shall be so located or constructed as to minimize the fire hazard. If the fuel tank is located above or immediately adjacent to the engine, suitable shielding shall be provided to prevent spillage during the filling operation, or leakage from the tank or fuel system, from coming in contact with the engine or any parts of the ignition and exhaust systems. All parts of the fuel system shall be constructed and installed in a workmanlike manner.

504 Pumps and other appurtenances carrying or containing flammable liquids shall be so located in relation to the engine that spillage or leakage from such parts shall be prevented from coming in contact with the engine or any parts of the ignition and exhaust system, or adequate shielding shall be provided to attain the same purpose. The engine cooling fan shall be so positioned, rotated or shielded as to minimize the possibility of drawing flammable vapors toward the engine.

505 When the engine is located in a position where spillage from the cargo tank or its appurtenances or from side racks might constitute a hazard, suitable shielding shall be provided to prevent such spillage from contacting the engine or engine exhaust system and for draining such spillage away from the vicinity of the engine.

506 Where the engine is carried within an enclosed space adequate provision shall be made for air circulation at all times, to prevent accumulation of explosive vapors and to avoid overheating.

507 The exhaust system shall be substantially constructed and installed and free from leaks. The exhaust line and muffler shall have adequate clearance from combustible materials and the exhaust gases shall be discharged at a location which will not constitute a hazard. When engines are carried as in paragraph 506, the exhaust gases shall be discharged outside of each such closed space.

508 The ignition wiring shall be substantially installed with firm connections and spark plug and all other terminals shall be suitably insulated, to prevent sparking in event of contact with conductive materials. The ignition switch shall be of the enclosed type.

510 Auxiliary Electric Generators and Motors

511 Electrical equipment, installed or carried upon a tank vehicle transporting Class I and II flammable liquids, for the operation of pumps or other devices used for the handling of product and operating product handling accessories shall meet the following requirements:

512 Electric generators driven from a power-take-off connected to the vehicle transmission or to an auxiliary transmission, or by an auxiliary internal combustion engine, shall be of the explosion proof type.

513 Electric motors shall be of the explosion proof type.

514 Wiring shall be adequate and substantially installed with all terminals firmly connected and insulated to prevent sparking from vibration or in event of contact with conductive materials. Wires shall have oil proof insulation. If overload protection is provided it shall be of the explosion proof type. All switches or other sparking devices shall be of the explosion proof type and all conduit entrances shall be sealed.

515 Where the generator or motor is located within an enclosed space

adequate provision shall be made for air circulation to prevent overheating and possible accumulation of explosive vapors.

516 Electrical equipment and wiring shall be located so as to prevent contact with spillage from cargo tank or side racks or suitable shielding shall be provided to attain equivalent protection.

600 Operation of Tank Vehicles

610 Proper Repair

611 Tank vehicles shall not be operated unless they are in proper repair, devoid of accumulation of grease, oil or other flammables, and free of leaks.

620 Filling and Discharging Tank Vehicles

621 The driver, operator or attendant of any tank vehicle shall not leave the vehicle while it is being filled or discharged. Delivery hose, when attached to a tank vehicle shall be considered to be a part of the tank vehicle.

622 Motors of tank trucks or tractors shall be shut down during making and breaking hose connections. If loading or unloading is done without the use of a power pump, the tank truck or tractor motor shall be shut down throughout such operations.

623 The cargo tank shall be bonded to the fill pipe when loading. The bond-wire connection shall be made prior to opening the dome covers. It shall be maintained in place during the entire filling operation and the dome covers shall be securely closed before the bond-wire is disconnected from the cargo tank.

624 No external bond-wire connection nor bond-wires integral with a hose are needed for the unloading of flammable liquids into underground tanks.

625 No cargo tank or compartment thereof used for the transportation of any flammable liquid shall be loaded liquid full. The vacant space (outage) in a cargo tank or compartment thereof used in the transportation of flammable liquids shall not be less than 1 per cent; sufficient space (outage) shall be left vacant in every case to prevent leakage from or distortion of such tank or compartment by expansion of the contents due to rise in temperature in transit.

630 No Smoking

631 Smoking by tank vehicle drivers, helpers, repairmen, or other personnel is prohibited while they are driving, making deliveries, filling, or making any repairs to tank vehicles.

640 Protection Against Intermixing

641 Conversion. No cargo tank compartment, the last preceding use of which was for Class I or II flammable liquid, shall be used for Class III flammable liquid until all Class I or Class II liquid has been completely drained from the compartment and from all piping and any pump, meter or hose connected thereto. If the compartment or any connected piping, pump, meter or hose will not drain completely, the Class I or II liquid shall be completely removed by other means.

642 Separation. If Class I or II flammable liquid and Class III flammable liquid are to be delivered by pump, meter or hose from different compartments of one cargo-tank load, separate withdrawal or metering equipment, whatever it may be, from the point where it is attached to the compartment outlet pipe to and including the dispensing nozzle or connection, shall be provided for Class I or II flammable liquid; and separate equipment, as aforesaid, shall be provided for Class III flammable liquid. Exception: Tank vehicles manufactured prior to the effective date of this standard may be continued in use without being so equipped, if (a) lines into the common outlets or to common manifolds are provided with valves which will permit only one compartment at a time to be emptied; and (b) the common outlet, pump, meter or hose, following use for Class I or II liquid, shall be cleared as required in paragraph 641 before being used for Class III flammable liquid.